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MONTANA
1982 NETWORK REVIEW

by

Robert Raisch

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1982 NETWORK REVIEW

INTRODUCTION

The U.S. Environmental Protection Agency (EPA) requires the Montana Department of Health and Environmental Sciences, Air Quality Bureau (AQB) to conduct an annual review of the state's ambient air monitoring network. This report is the fourth in the series. EPA's requirements, as set forth in 40 CFR 58.20, are (1) to determine if the system meets the monitoring objectives defined in Appendix B of 40 CFR 58.20, and (2) to identify needed modifications of the network, such as termination or relocation of unnecessary stations or establishment of new stations that may be necessary. 40 CFR 58.25 requires the Bureau to develop and to implement an annual schedule to modify the network in order to eliminate any unnecessary stations or to correct any inadequacies indicated by the results of the annual review. The Bureau must consult with the Regional Administrator of the EPA during the development of the schedule to modify the monitoring program. The final schedule and modifications are subject to the approval of the Regional Administrator.

In order to conduct this review, the monitoring objective and spatial scale of representativeness of each station, existing or proposed, are first examined to determine whether they represent the area's air quality situation. Background information, such as maps, climatological summaries, emission inventories, traffic counts, and modeling results, are gathered and reviewed. The opinions of the Bureau staff, the personnel of three county air pollution agencies in the state, and staff members of the Helena EPA office also are solicited.

In the 1979 Network Review, the AQB designated each monitoring site in the State as either National Air Monitoring Stations (NAMS), State and Local Air Monitoring Stations (SLAMS), or Special Purpose Monitoring Stations (SPM). The NAMS/SLAMS network is designed to meet four basic monitoring objectives: (1) to determine the highest concentrations expected to occur in the area covered by the network (concentration); (2) to determine representative concentrations in areas of high population density (population); (3) to determine the impact on ambient pollution levels of significant sources or source categories (source); and (4) to determine general background concentration levels (background). Each station in the NAMS/SLAMS network also is sited so that the air sampled is representative of certain spatial scales, which are defined as follows:

Microscale: defines the concentrations in air volumes associated with area dimensions ranging from several meters up to about 100 meters.

Middle Scale: defines the concentration typical of areas up to several city blocks in size with dimensions ranging from about 100 meters to 0.5 kilometers.

Neighborhood Scale: defines concentrations within some extended area of the city that has relatively uniform land use with dimensions in the 0.5 to 4.0 kilometers range.

Urban Scale: defines the overall city-wide conditions with dimensions on the order of four to 50 kilometers. This scale usually would require more than one site for definition.

Regional Scale: usually defines a rural area of reasonably homogeneous geography and extends from tens to hundreds of kilometers.

National and Global Scales: these measurement scales represent concentrations characterizing the nation and the globe as a whole.

In order to site a monitoring station properly, both the monitoring objective and the spatial scale of representativeness must be determined. Appropriate siting scales for the various monitoring objectives are listed in Table 1.

TABLE 1

MONITORING OBJECTIVES AND APPROPRIATE SITING SCALES

Monitoring Objective	Siting Scales
Highest concentration	Micro, middle, neighborhood (sometimes urban)
Population	Neighborhood, urban
Source impact	Micro, middle, neighborhood
Background	Neighborhood, regional

The goal in siting stations is to match correctly the spatial scale represented by the sample of monitored air with the spatial scale most appropriate for each station's monitoring objective. During the process of the first network review in 1979, existing stations were evaluated for their monitoring objective and siting scale and, if necessary, the stations were modified. New stations established since then have been sited in accordance with the monitoring objective and siting scale determined in advance.

The AQB developed this network review as a supplement to the comprehensive 1981 Network Review. The Bureau intends to perform another more thorough review in 1983.

Over the last twelve months the Montana AQB has experienced a series of budget cuts which have made it impossible to carry out many of the objectives

listed in the 1981 Network Review. It is anticipated that additional budget restrictions during 1982 and 1983 will not only preclude the accomplishment of these objectives but will actually result in reduction of the existing monitoring network.

TOTAL SUSPENDED PARTICULATES (TSP)

TSP is the most ubiquitous pollutant in Montana, affecting the entire state. Major sources of particulates include: industrial activity, coal mines, unpaved roads, agricultural activity and residential wood burning. Table 2 lists estimated total particulate emissions by county, as determined by PEDCo ENVIRONMENTAL, INC. The highest particulate concentrations in Montana are found in urban areas such as Billings, Butte, Kalispell, and Missoula. Particularly in the western valleys, winter inversions allow particulate levels to increase and to remain high for days or weeks at a time. Some rural areas also show high particulate levels, due not only to agricultural activities and unpaved roads, but also to coal mines and other industrial sources.

TABLE 2

1974 PARTICULATE EMISSION RATES BY COUNTY

County	Tons/Year
Flathead	83,687
Gallatin	81,132
Lewis and Clark	66,076
Missoula	54,345
Yellowstone	53,695
Ravalli	53,683
Cascade	51,529
Lake	48,455
Roosevelt	44,290
Fergus	42,225
Lincoln	36,480
Big Horn	35,092
Valley	34,956
Carbon	34,880
Powell	34,616

All of Montana's TSP monitors are sited according to the neighborhood, urban or regional scale (see Table 22). Selection of the appropriate siting scale is dependent on the station's monitoring objective. The monitoring objective for most stations is "population". In most cases, these "population" stations are sited according to the "neighborhood" scale, which corresponds to areas with dimensions from 0.5 to 4.0 kilometers.

For those stations designed to determine the impact of particulate sources on ambient particulate concentrations, the monitoring objective is "source". Most of the particulate monitoring around air pollution sources is conducted by the companies responsible for the emissions. The Bureau will receive data from company sites and conduct periodic audits of the sites and data. All "source" stations are sited according to the "neighborhood" scale, with the exception of the Scobey Border Station, which is scaled regional.

Several stations in urban areas are designed to monitor areas of highest concentration, and are sited according to the "neighborhood" scale.

"Background" stations are chosen to determine concentrations of particulates in areas remote from man-made sources. The Bureau considers that a minimum of two background stations are required in Montana, one in the eastern part of the state to characterize background concentrations in the plains, and another in a western valley for the mountainous portion of the state. Ovando, in Powell County, serves as the western Montana background station while Lindsay in Dawson County comprised the eastern Montana station until February, 1982, when it was destroyed by a wind storm. The AQB planned to move the Lindsay station to the vinicity of Winnett, Montana, but budget restraints delayed us. All three background sites were or would be sited according to the "regional" scale.

Appendix A of 40 CFR58 requires that at least two stations in the network be selected for duplicate sampling and that two samplers be co-located at these sites. Sites with the highest expected geometric mean concentrations must be chosen. Table 3 lists stations where the Bureau and the county agencies have co-located samplers.

TABLE 3

CO-LOCATED HIGH VOLUME SAMPLERS

City	Site
Billings	Taft School (NAMS)
Billings	City Hall (SLAMS)
Great Falls	Downtown (NAMS)
Butte	Greeley School (SLAMS)
Missoula	Courthouse Roof (SLAMS)
Missoula	Rose Park (SLAMS)
Missoula	HW#1 (SPM)
East Helena	Hadfield (SLAMS)

Montana's network of NAMS stations for TSP consists of two stations selected from the SLAMS network. NAMS are required in urban areas larger than 50,000 population. In Montana only Great Falls and Billings have Standard Metropolitan Statistical Areas with populations in excess of 50,000. The TSP NAMS criteria are given in Table 4. Based on these criteria, both Billings and Great Falls fall into the "medium" concentration range and thus require one to two NAMS stations each. The Bureau has established a NAMS station at Taft School in Billings and the Cascade County Air Pollution Control Agency has established one at the public library in downtown Great Falls. The monitoring objectives of both these stations are "highest concentration" and "population", and both are sited according to the "neighborhood" scale of representativeness.

TABLE 4

TSP NATIONAL AIR MONITORING STATION CRITERIA*

Population Category		Concentration High	Medium	Low
High population	over 500,000	6-8	4-6	0-2
Medium population	100,000-500,000	4-6	2-4	0-2
Low Population	50,000-100,000	2-4	1-2	0

*Approximate number of stations per area

High concentration - exceeding level of the primary NAAQS by 20 percent or more.
Medium concentration - exceeding secondary NAAQS
Low concentration - less than secondary NAAQS

The AQB did not perform any statistical analysis to compare TSP data from different sites similar to that conducted during the 1981 Network Review. It is the Bureau's contention that the results would be very similar and the time and effort not warranted on a yearly basis. It is the AQB's intention to perform such analyses in conjunction with the 1983 Network Review and each odd year thereafter.

It should be noted that the recommendations for maintaining or terminating a station must be based on a number of criteria including projected growth in the area of the sampling site, the pollutant concentrations at the site (especially if they equal or exceed the standards), and funding. Table 17 prioritizes the proposed network modifications, so that fiscal restraints can be considered during the implementation phase.

Billings

1. A summary of 1981 TSP data for the Billings area is included in Table 9.

2. Billings area total suspended particulate levels were slightly lower in 1981 than 1980. The City Hall, Taft School, and KGHL sites registered annual geometric means which were 7 percent, 11 percent, and one percent lower respectively. At Grand Avenue the geometric mean for TSP remained constant at 72 ug/m^3, while the Lockwood School increased 20 percent. The Bench school was shut down during December of 1980 and so no comparison could be made.

3. The AQB is confident that the detailed analysis contained in the 1981 Network Review is still applicable and therefore is recommending only minor modifications to the Billings' particulate network. These modifications are an effort to minimize expenses and still maintain a viable program. The suggested modifications are listed below.

   a. Move the Lockwood School high volume sampler approximately 0.5 miles north to the Lockwood Park sulfur dioxide site. This will allow the AQB to eliminate the Lockwood School site and associated expenses. The new location remains on the valley floor and in the geographical center of the Lockwood area.

   b. Move the KGHL site to the old Bench School site. The need for a monitor in this rapidly expanding area of Billings outweighs the need for a background site at KGHL.

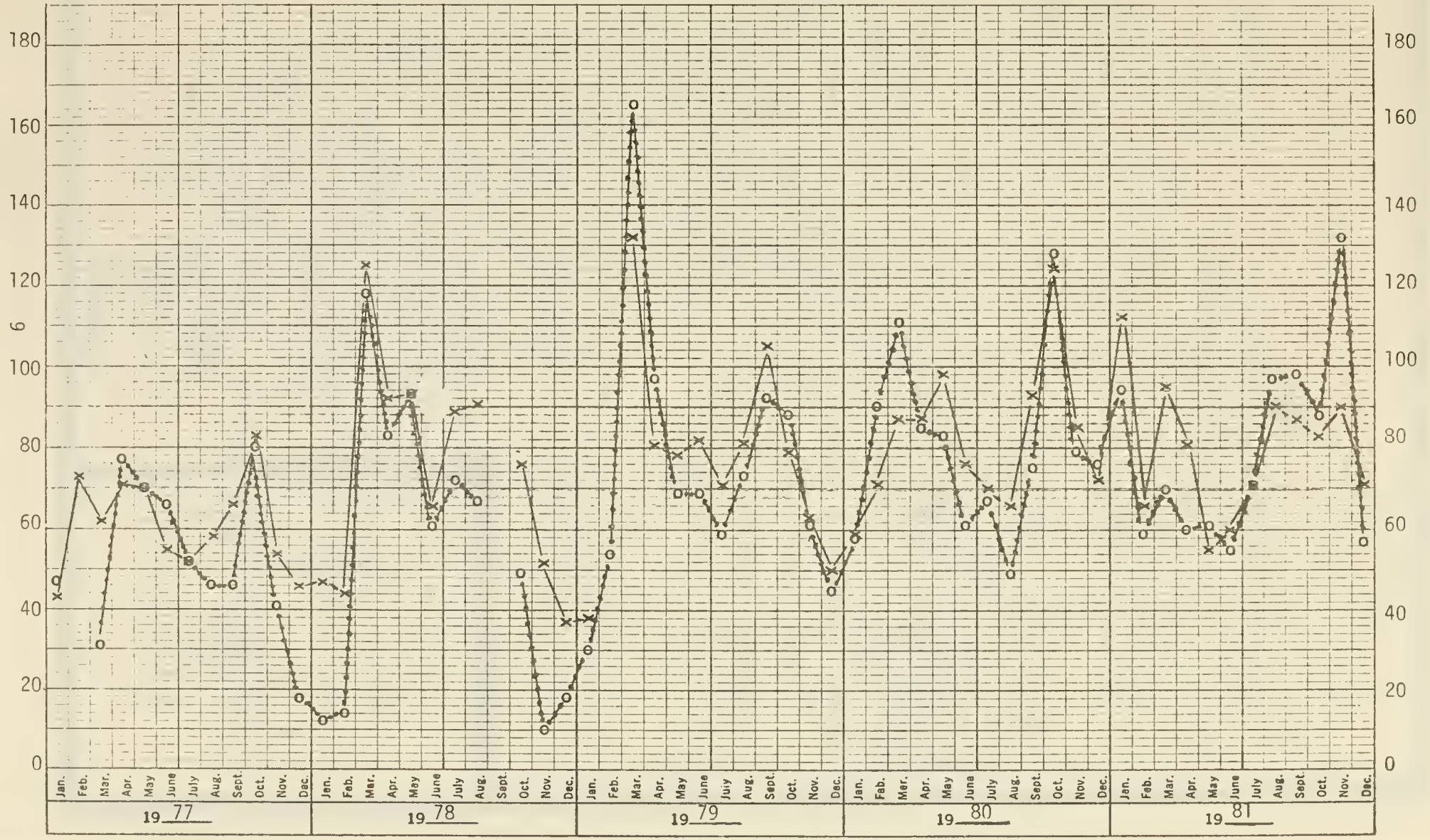
   c. Postpone plans to establish a high volume sampler near Poly Drive due to lack of funding.

5. The AQB recommends the continued operation of samplers at Grand Avenue, City Hall and Taft School. These locations register the highest concentrations in Billings and are essential to track the effectiveness of the non-attainment area control strategies. Figure 1 describes the relationship between TSP levels at Grand Avenue and City Hall.

Billings

Total Suspended Particulate
(micrograms/cubic meter)
Monthly Means

—x— City Hall
—o— Grand Avenue



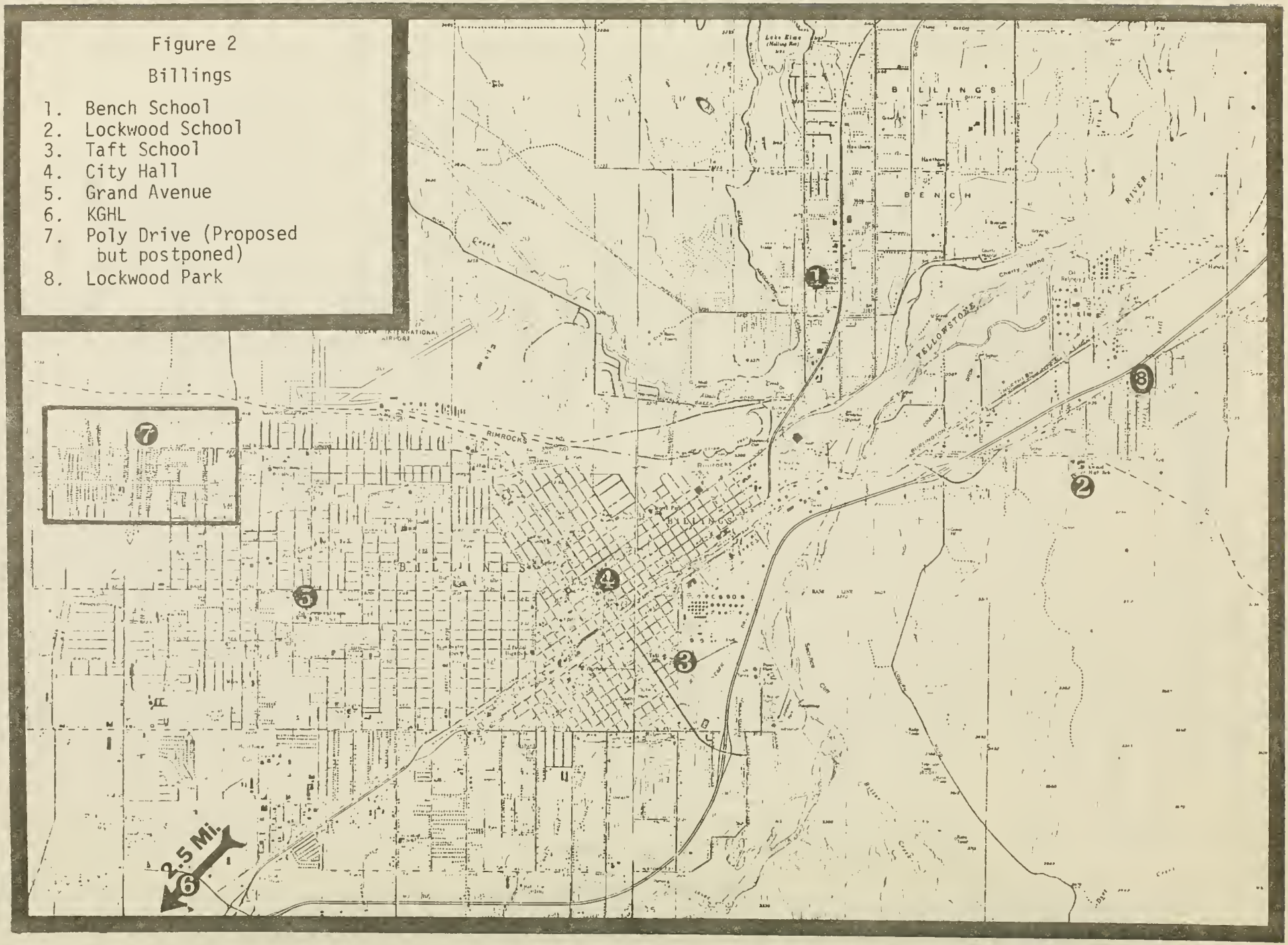


Figure 2
Billings
1. Bench School
2. Lockwood School
3. Taft School
4. City Hall
5. Grand Avenue
6. KGHL
7. Poly Drive (Proposed but postponed)
8. Lockwood Park
BILLINGS
BENCH
RIVER
YELLOWSTONE
RIMROCKS
2.5 Mi.

Butte

1. During 1981 the TSP geometric mean at the Dr. Canty and Hebgen Park sites decreased 26 percent and 12 percent respectively. On the other hand, concentrations at the Greeley School and Walkerville sites increased by 8 percent and 7 percent. Butte TSP levels are summarized in Table 9.
2. During the fall and winter of 1981 and 1982 a limited analysis of Butte TSP was conducted utilizing the chemical mass balance technique. Results of this analysis have not been reported to date.
3. The AQB is confident that the data analysis performed during the 1981 Network Review is still pertinent. However, since then an additional analysis of TSP data from the Greeley School site was performed by Phillip Tourangeau and Carolyn Johns of the University of Montana, Environmental Studies Laboratory. The results of their analysis are summarized below:
   a. Since 1977 all 24-hour TSP concentrations at the Greeley School greater than 150 ug/m^3 occurred during the months of October through March.
   b. Average wintertime TSP concentrations since 1977 at the Greeley School do not track periods of cold weather as indicated by heating degree days. Although winter is when high TSP levels occur in Butte, warm winters do not appear to result in lower TSP concentrations.
   c. Precipitation does not show any relationship to concentrations of TSP at the Greeley School site.

d. The authors reiterated the results of a 1982 Butte meteorological review by Air Service Inc. which concluded that in general, on high TSP concentration days, synoptic stagnation is present, with clear skies and low wind speeds.

e. On an annual basis, Berkeley Pit emissions tracked TSP levels at the Greeley School (Table 5) until 1978 and 1979 (r=.78). When the years of 1980 and 1981 were included in the data set, the correlation decreased to r=.51. However, on a monthly basis Berkeley Pit emissions exhibited no relationship to TSP levels.

f. During 1975 through 1980 the annual geometric mean for TSP at the Greeley School correlated well with Butte city emissions (Table 6)(r=.88). The correlation improved to r=.99 when 1979 and 1980 data were eliminated.

g. Organic carbon levels were very high in Butte during the winter of 1980, suggesting residential wood burning as a significant source.

After reviewing these results, the AQB finds that in recent years TSP at the Greeley School is being influenced less by the Berkeley Pit and traditional city emissions and more by an unknown source or sources, possibly residential wood burning.

4. Based on the analysis performed in the 1981 Network Review and more recent studies, the AQB recommends the elimination of the Walkerville site and the cancellation of the proposed downtown site due to fiscal restraints.

TABLE 5

COMPARISON OF BERKELEY PIT EMISSIONS AND GREELEY SCHOOL TSP

Year	Estimated Berkeley Pit Emissions (tons)	Greeley School Geometric Mean (ug/m^3)
1975	49,165	106
1976	41,050	100.0
1977	30,853	79
1978	32,347	68
1979	39,029	80.4
1980	13,044	74.2
1981	20,297	79.6

TABLE 6

COMPARISON OF BUTTE CITY EMISSIONS AND GREELEY SCHOOL TSP

Year	Estimated Butte City Emissions,(Tons)	Greeley School Geometric Mean (ug/m^3)
1975	17,709	106
1976	17,336	100.6
1977	13,278	78.7
1978	11,474	68.6
1979	11,186	80.4
1980	10,432	74.2

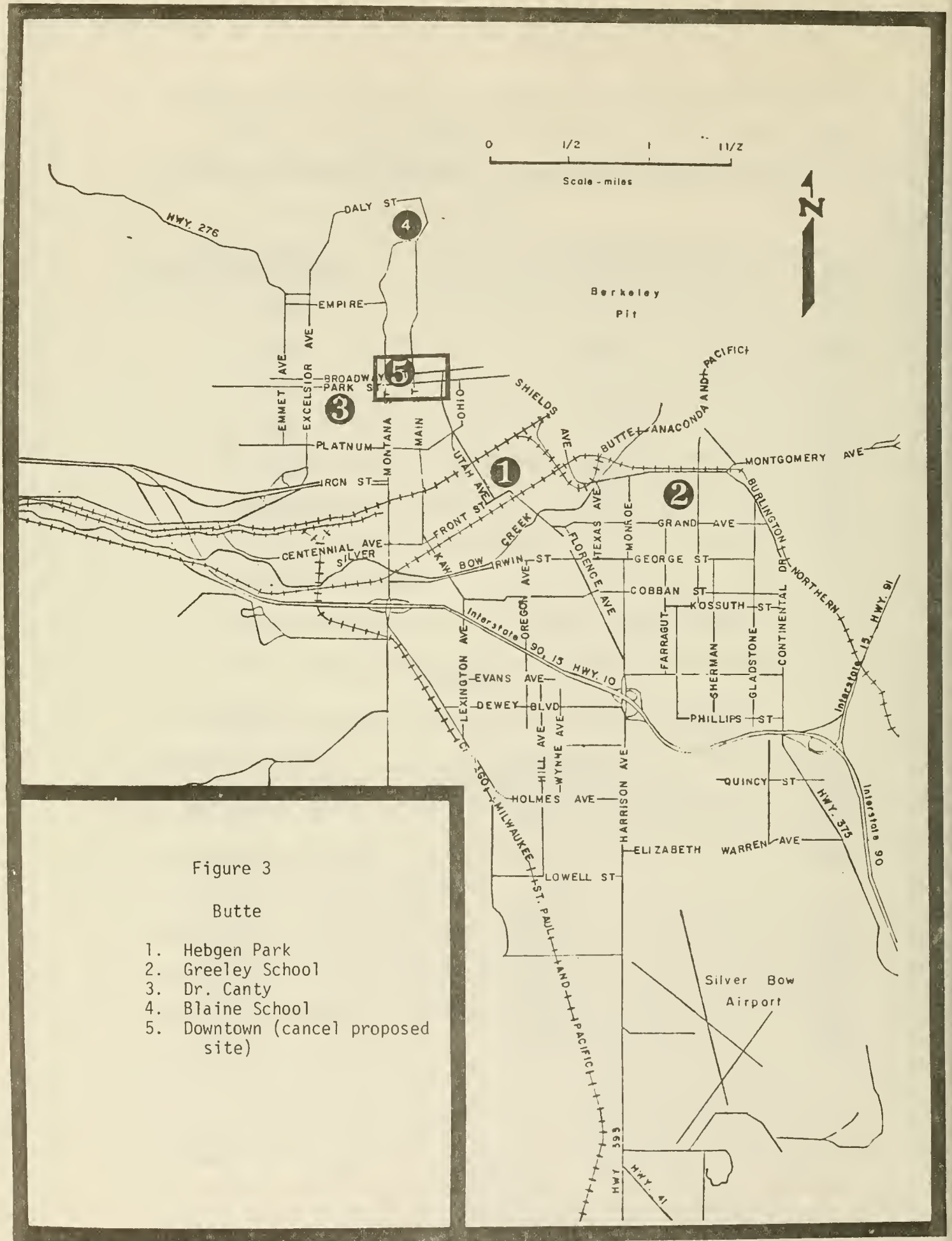


Figure 3

Butte

1. Hebgen Park
2. Greeley School
3. Dr. Canty
4. Blaine School
5. Downtown (cancel proposed site)

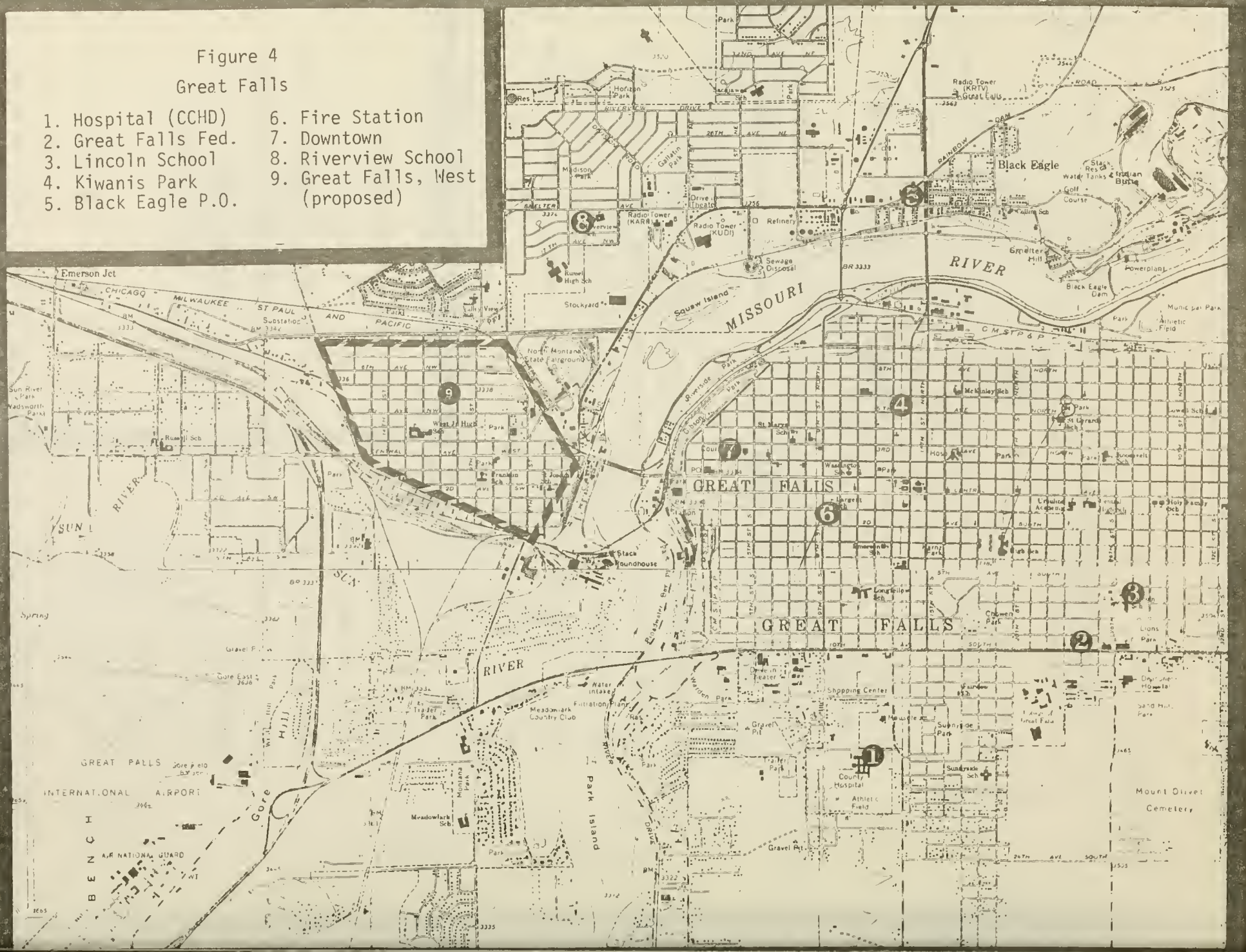
Great Falls

1. In 1981, TSP concentrations decreased at those Great Falls sites which historically have shown high levels and increased at the others. The Fire Station site in downtown Great Falls showed a 4 percent reduction in the annual geometric mean for TSP from 72 ug/m^3 to 69 ug/m^3. The Fire Station was the only Great Falls location to exceed either the federal 24-hour or annual secondary standard. Table 9 summarizes all the TSP data for the Great Falls sites.
2. The AQB utilized the data analysis performed during the 1981 Network Review and more current data to make the recommendations included in this report.
3. The AQB recommends that the Downtown and the Fire Station sites continue to be operated due to the relatively high TSP concentrations registered there: 55 ug/m^3 and 69 ug/m^3 respectively. In addition, these locations are extremely valuable for tracking TSP levels in the downtown central business district.
4. The AQB also recommends the continued operation of the Black Eagle site despite the permanent shutdown of the Anaconda Copper refinery. TSP levels averaged 58 ug/m^3 last year, only 2 ug/m^3 below the federal secondary standard.
5. After at least two years of sampling at the Riverview School, Kiwanis Park, Lincoln School and CCHD sites, the AQB recommends they be permanently shut down. Concentrations at all sites averaged less than 50 ug/m^3 during 1981. In light of continuing budget restraints, closure seems reasonable.

Figure 4

Great Falls

1. Hospital (CCHD)
2. Great Falls Fed.
3. Lincoln School
4. Kiwanis Park
5. Black Eagle P.O.
6. Fire Station
7. Downtown
8. Riverview School
9. Great Falls, West (proposed)



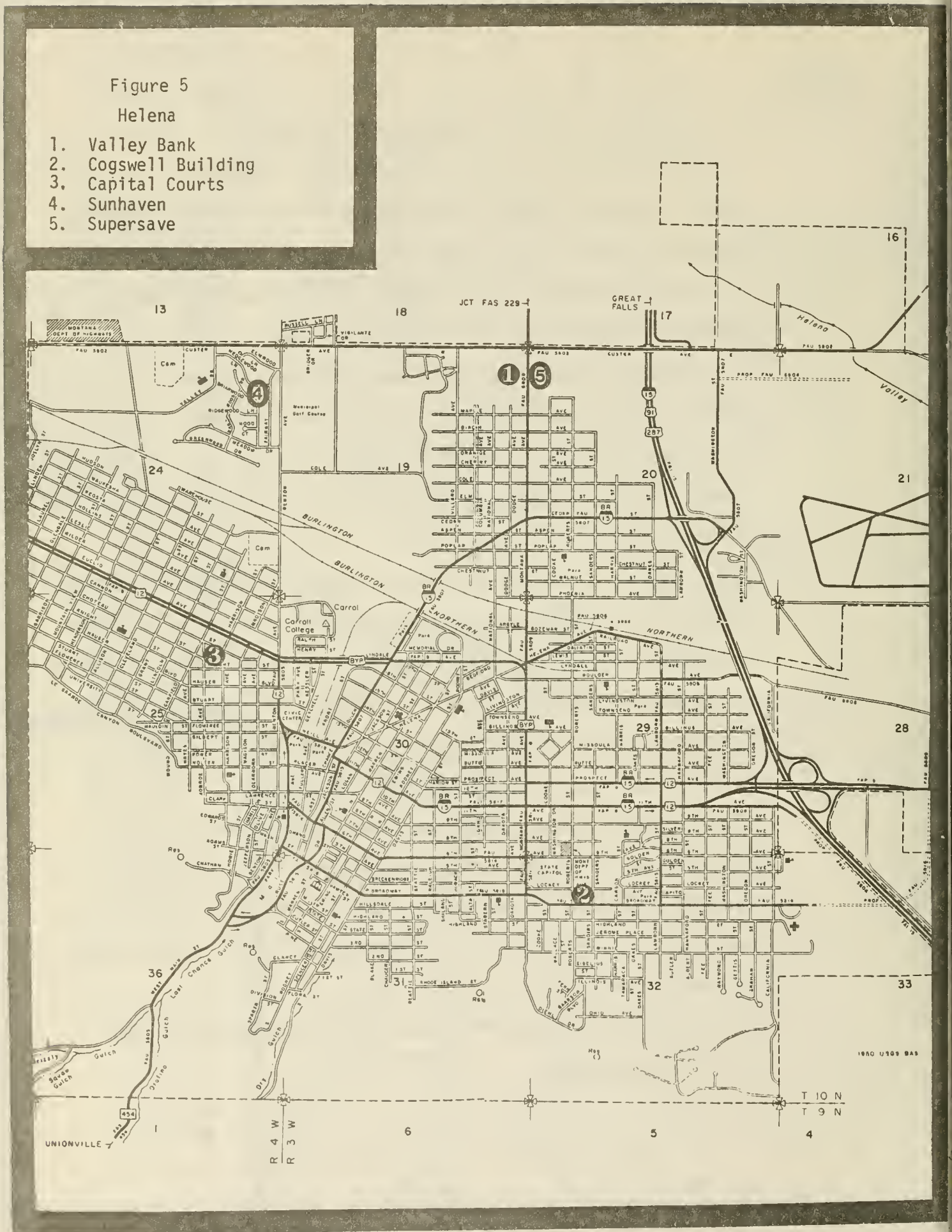
Helena

1. All three Helena samplers showed drastic reductions in TSP concentrations during 1981. TSP levels dropped 26 percent at Capital Courts, 24 percent at the Valley Bank, and 32 percent at the Cogswell Building. A general improvement in atmospheric dispersion during the fall and early winter of 1981 is most likely responsible for the reductions, although the new voluntary air quality alert program initiated by the Lewis and Clark County Health Department may have helped. Through this program city residents are asked to stop all unnecessary wood burning during periods of stagnant air and high TSP concentrations. A summary of Helena area TSP levels is contained in Table 9.
2. During 1981 the Lewis and Clark County Health Department continued to operate high volume samplers at Capital Courts and the Valley Bank. In November of 1981, the Valley Bank site was moved across the street to the roof of the Super Save Grocery. This was necessary due to the difficulty in obtaining access to the roof of the Valley Bank.
3. For a ten-week period during February, March and April, 1981, the Lewis and Clark County Health Department ran a temporary site in a southwest section of Helena known as Sunhaven. The geometric mean of 48 ug/m^3 and highest 24-hour TSP reading of 108 ug/m^3 indicated that the levels were similar to other Helena sites and the Sunhaven site was deemed unnecessary.
4. The AQB recommends no modifications to the existing Helena high volume sampler network.

Figure 5

Helena

1. Valley Bank
2. Cogswell Building
3. Capital Courts
4. Sunhaven
5. Supersave



East Helena

1. East Helena is a small community about five miles east of Helena and is the site of the ASARCO lead smelter. East Helena has recently experienced residential growth along its southern and eastern edges.
2. The AQB has operated two high volume samplers in East Helena for several years. They are the Hastie residence and the A&W site. During late 1980 and early 1981, the AQB in cooperation with the ASARCO lead smelter, established nine new high volume sampler sites. These sites initially were calibrated and maintained by the AQB and operated by ASARCO. During mid-1981 an independent contractor was hired to handle the entire monitoring project and on January 1, 1982, the AQB assumed total responsibility. The primary purpose of the new sites was to determine ambient lead concentrations; but of course TSP was also monitored.
3. Average TSP concentrations at the historic Hastie residence and A&W sites showed decreases during 1981. Hastie dropped 22 percent to 67 ug/m^3 and for the first time since 1977 met the federal primary standard of 75 ug/m^3. At the A&W site, TSP levels also dropped by 18 percent to 55 ug/m^3 meeting all but the federal 24-hour secondary standard. Due to high TSP levels and its historic significance, the AQB will continue to operate the Hastie site. However, the A&W site was discontinued in January of 1982 based on the lower TSP concentrations observed there, fiscal restraints, and additional requirements dictated by higher lead concentrations in other areas of East Helena. In addition, the 1981 Network Review showed that the A&W site and Hastie sites were essentially sampling the same TSP sources with a correlation coefficient of r=.812.

4. Table 9 summarizes the TSP concentrations observed at the nine new East Helena sites. Only the Canal site, located 0.5 miles west of the smelter, and the Vollmer site, located 1.7 miles west southwest of the smelter, operated for the entire year. Both registered very low TSP levels. Due to relatively low lead values, these sites were terminated in January of 1982.

   The Padbury and Microwave sites also showed low TSP and lead concentrations and were shut down in January.

   The Dartman and South sites recorded low average TSP concentrations at 44 ug/m^3 and 39 ug/m^3, respectively. However, the AQB intends to continue operating these sites due to lead concentrations near the 1.5 ug/m^3 quarterly standard.

   The Fire Hall site was operated for approximately four months in 1981 until a problem with the City of East Helena developed and the site was moved to the Hadfield location. Both locations are within 200 yards of each other. The AQB will continue to operate the Hadfield site because of lead violations and a geometric mean for TSP of 81 ug/m^3 for the last five months of 1981.

5. The AQB intends to operate the Dartman, Hastie, Hadfield and South sites indefinitely as SLAM stations to track TSP and lead concentrations.

6. During 1980 and 1981 the AQB received several complaints from residents of Montana City conerning air pollution in the area. Since Montana City is located near the Kaiser Cement plant and the ASARCO smelter and the area is experiencing rapid residential growth with associated air pollution, the AQB installed a high volume sampler at the Montana City School. Sampling was conducted for a short period

during February, March and April of 1981, but was temporarily stopped, since the sampler was needed in another location in conjunction with the East Helena lead study. However, TSP concentrations were higher than expected, with a geometric mean of 73 ug/m^3 and a 24-hour high of 422 ug/m^3. Therefore, the AQB reopened this site during February of 1982 and plans to operate the site as a SPM for at least one full year.

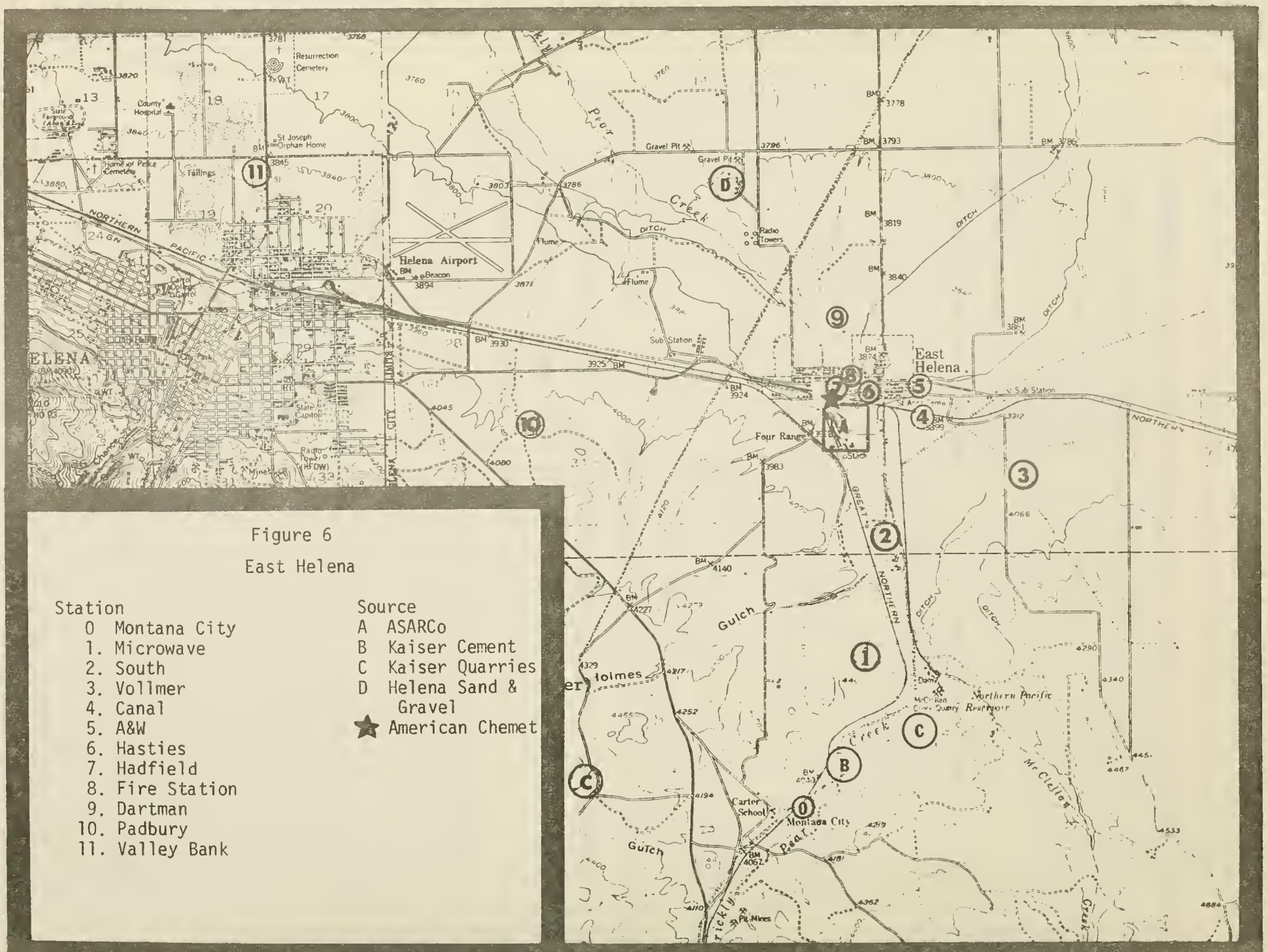


Figure 6

East Helena

Station
- 0 Montana City
- 1. Microwave
- 2. South
- 3. Vollmer
- 4. Canal
- 5. A&W
- 6. Hasties
- 7. Hadfield
- 8. Fire Station
- 9. Dartman
- 10. Padbury
- 11. Valley Bank

Source
- A ASARCo
- B Kaiser Cement
- C Kaiser Quarries
- D Helena Sand & Gravel
- ★ American Chemet

Missoula

1. All Missoula area monitoring sites recorded lower TSP concentrations during 1981 except the Schilling Street site. At some locations such as the Courthouse Roof and Rose Park, the reductions were significant. The Missoula County Health Department believes that control measures aimed at reducing emissions of re-entrained street dust and residential wood burning are responsible for the reductions, although unusually good dispersion conditions during 1981 also contributed. Missoula area TSP levels are summarized in Table 9.
2. The AQB considers the analysis performed during the 1981 Network Review as still applicable and has used the information in the following recommendations.
3. Rose Park experienced a 29 percent decrease in the mean TSP concentration during 1981. Levels dropped from 79 ug/m^3 in 1980 to 56 ug/m^3 in 1981. Rose Park houses co-located high volume samplers and is the major monitoring site south of the Clark Fork River. It is an essential part of the Missoula network and will continue to be operated.
4. During 1981 TSP levels at the Courthouse Roof declined 21 percent to 62 ug/m^3. 1981 is the first year that the Courthouse Roof met the federal primary standard of 75 ug/m^3 since 1975. The AQB recommends that this site continue to be operated.
5. The Missoula County Health Department terminated the Schilling Street site in August of 1981. The site was originally installed to observe the results of a paving project in the area. The data gathered spans the time period from before the project began when most of the streets were gravel, through the construction phase and after completion. Missoula County shut down the site due to some siting

problem described in the 1981 Network Review and because the objectives of the site were accomplished. Levels have remained high, however, with a geometric mean of 102 ug/m^3 for the first eight months of 1981. Therefore, the AQB continues to recommend the establishment of a properly sited station in this part of the city.

6. During 1981 the Missoula County Health Department established a new site at Boyd Park to monitor CO emissions from residential wood burning. This location was selected based on a survey conducted in 1980 that indicated very heavy use of wood in the area and low vehicle traffic. In conjunction with the new CO monitoring site, TSP sampling was initiated in November of 1981. With only two months of data available in 1981, the AQB calculated the geometric mean at 81 ug/m^3. Missoula County plans to operate the Boyd Park site at least through the winter of 1982 and 1983.
7. Missoula County is still considering establishing a high volume sampling site at the Northside Cemetary. However, they have postponed plans for a site in Grant Creek in favor of a location in or near Lolo. Lolo is a small community seven miles south of Missoula and has never been monitored for TSP. In addition, Missoula County has no plans to locate a site in the Target Range area as suggested by the AQB in the 1981 Network Review.
8. Missoula County has long-range plans to establish TSP monitoring sites in East Missoula and, as mentioned earlier, Grant Creek. However, these modifications are at last one year away.

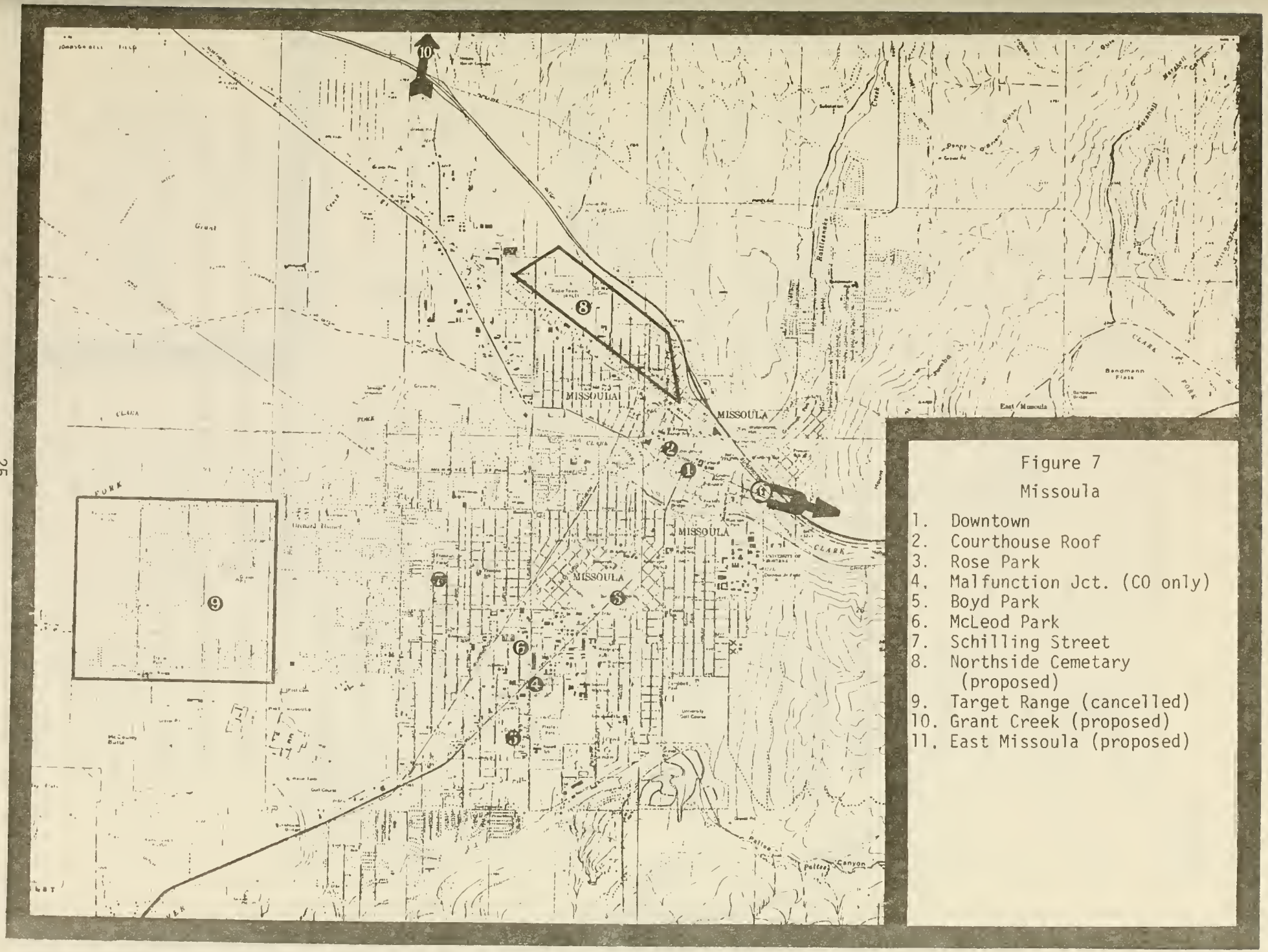


Figure 7

Missoula

1. Downtown
2. Courthouse Roof
3. Rose Park
4. Malfunction Jct. (CO only)
5. Boyd Park
6. McLeod Park
7. Schilling Street
8. Northside Cemetary (proposed)
9. Target Range (cancelled)
10. Grant Creek (proposed)
11. East Missoula (proposed)

Bozeman

1. Despite the fact that only the Traphagen Hall site has recorded at least two full years of data, it appears that TSP levels dropped significantly in 1981. The geometric mean at Traphagen Hall declined 31 percent, while MSU Family Housing and the East Main site dropped 2 percent and 33 percent respectively. In 1981 none of the Bozeman sites exceeded the federal primary standards, although TSP at the East Main sampler exceeded the annual and 24-hour secondary standards. A summary of Bozeman TSP data is contained in Table 9.
2. As recommended in the 1981 Network Review, the MSU Family Housing site was relocated. The new site was established in the north half of the city at the Whittier School. This site lies on the west edge of a residential area and one block east of Seventh Avenue, which is a major arterial. The AQB initiated sampling in early December and the mean TSP concentration for the month was 56 ug/m^3.
3. The East Main site is the primary location in the Bozeman particulate network and AQB intends to continue to operate it.
4. The Traphagen Hall site is located on top of Traphagen Hall approximately 15 meters above ground level. TSP concentrations at Traphagen Hall are generally low, probably due to its elevated location and the lack of emission sources in the campus area. The sampler is owned and operated by Montana State University, while the AQB performs the filter analysis. Due to the low concentrations registered at this site, its elevated location, and budget restraints, the AQB will no longer provide free filter analysis for this site. Montana State University may decide to perform the filter analysis in the University laboratory or pay the AQB for these services. If so, the AQB will continue to process the data through our data system if Montana State University so wishes.

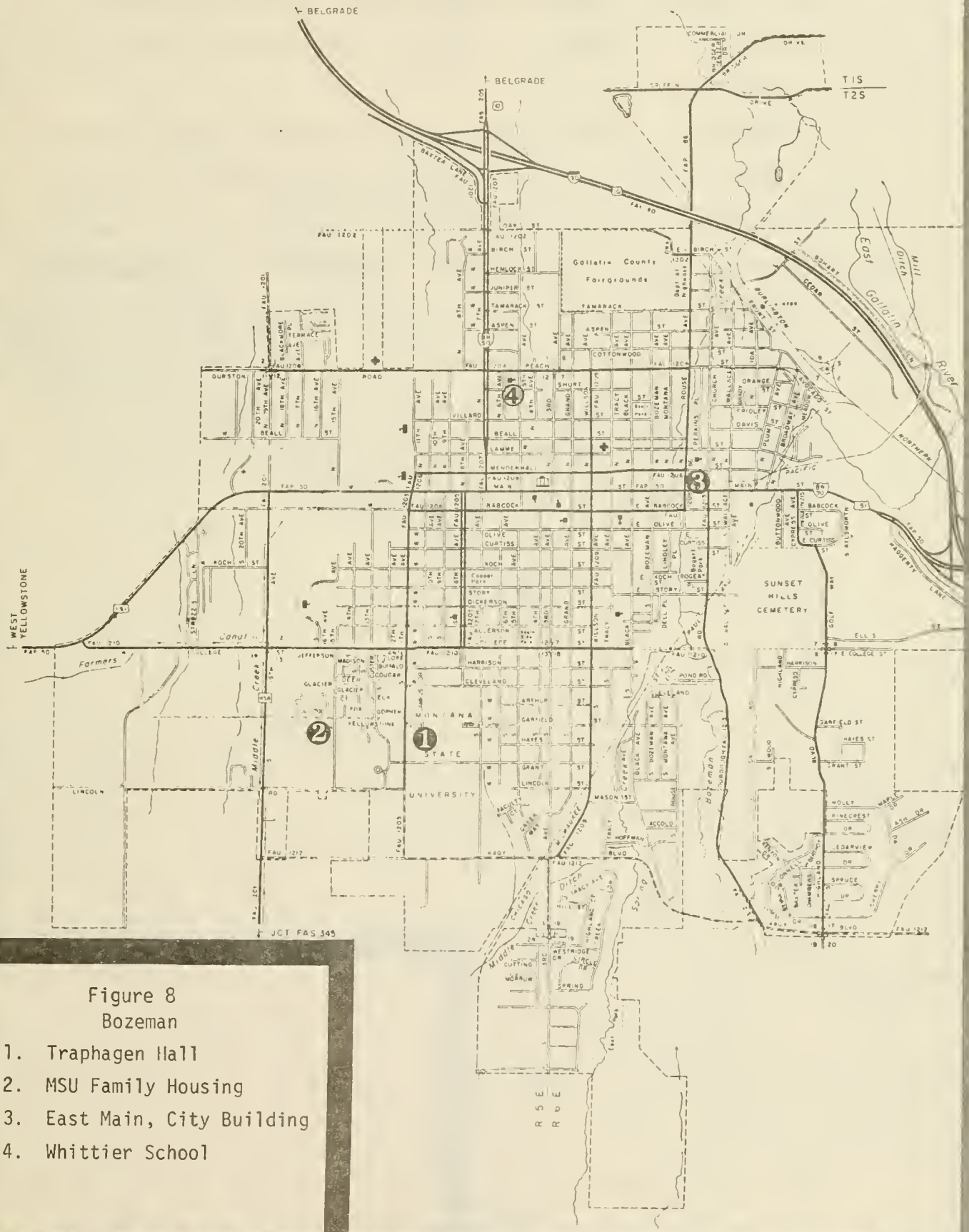


Figure 8
Bozeman

1. Traphagen Hall
2. MSU Family Housing
3. East Main, City Building
4. Whittier School

Anaconda

1. As recommended in the 1981 Network Review, the AQB terminated sampling at the Highway Junction and the Warm Springs Hospital sites during 1981.
2. The AQB has continued to operate the Lincoln School site in the east part of Anaconda despite the fact that the geometric mean was quite low during 1981, registering 45 ug/m^3. The AQB intends to operate this site at least through 1983. The site may be integrated into a particulate monitoring network to track particulates and their elemental constituents during demolition of the Anaconda smelter complex and subsequent clean-up. This network will include two additional sites in the vicinity of Mill Creek and Warm Springs and will probably be operated by the Anaconda Company.

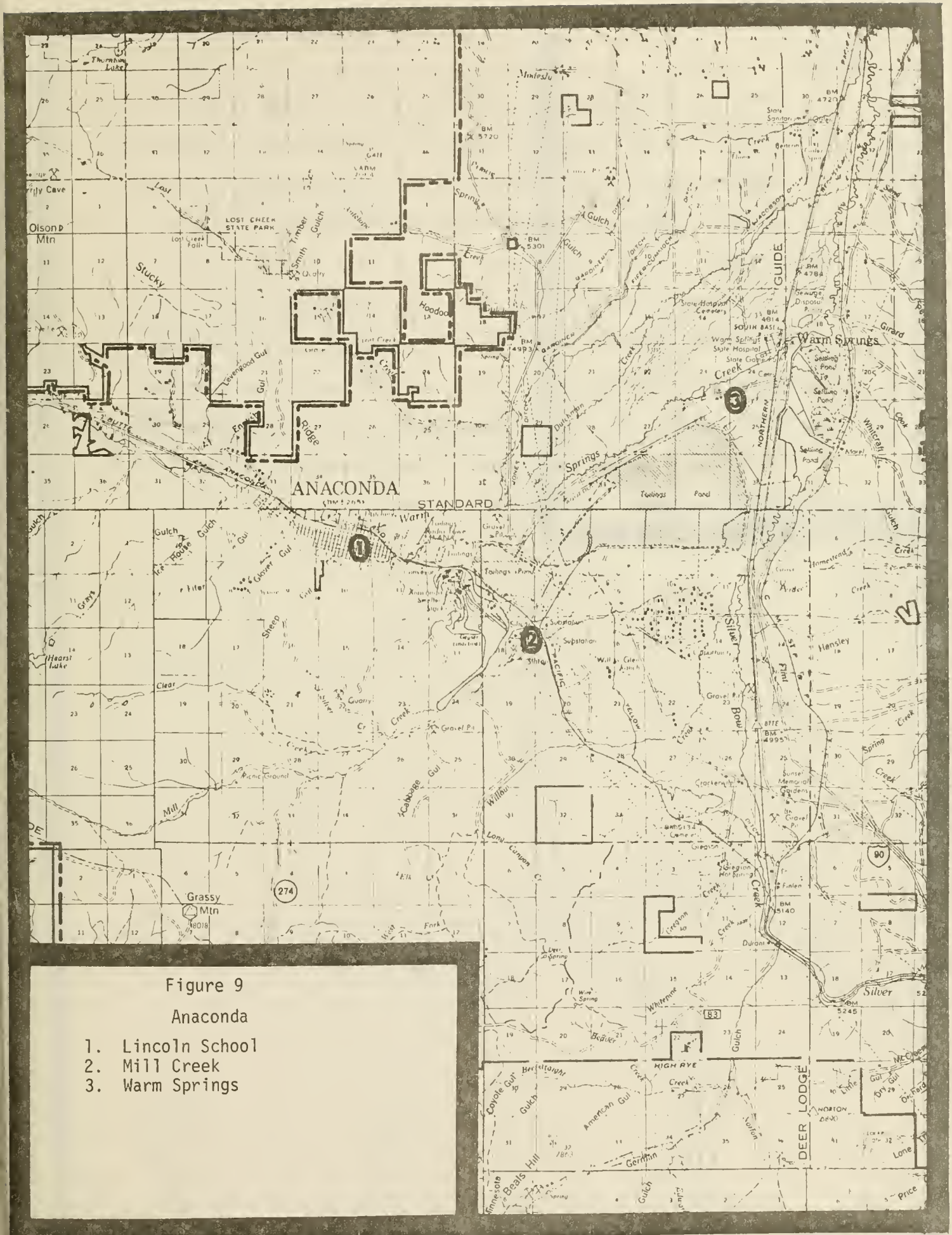


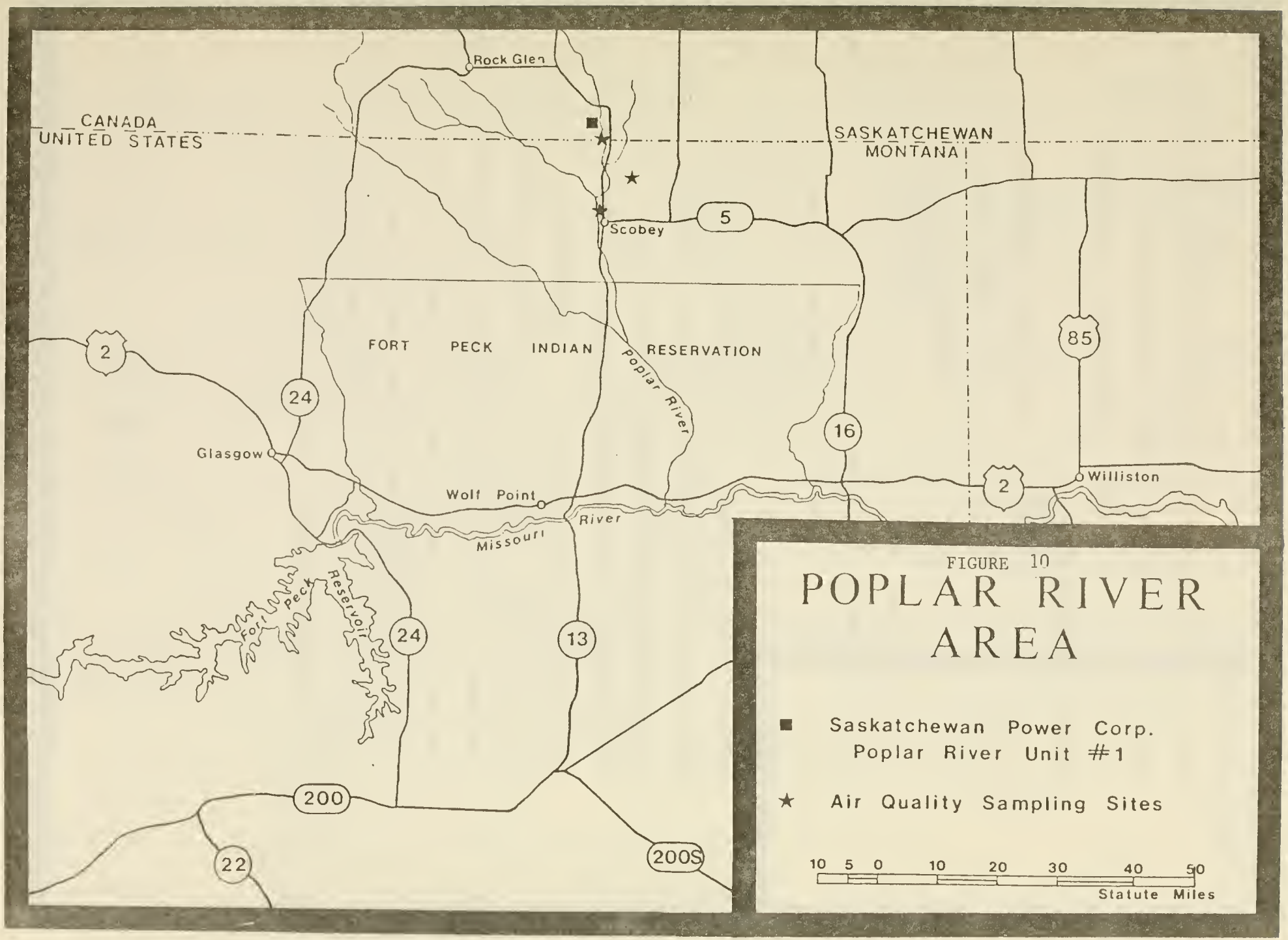
Figure 9

Anaconda

1. Lincoln School
2. Mill Creek
3. Warm Springs

Scobey

1. There are three TSP monitoring sites in the vicinity of Scobey. They are operated by the AQB in conjunction with the Poplar River Project. They include the Border site, located at the Canadian border, the Hanrahan site, northeast of Scobey, and the Richardson site just north of town.
2. The purpose of the sites are to measure background particulate levels and to determine the impact of two 300-megawatt coal-fired power plants being built approximately 18 miles north of Scobey near Coronach, Saskatchewan. The first plant began testing during October of 1980 and the second is scheduled for startup during November of 1982.
   The AQB recommends no change in this network.


Rock Glen
CANADA
UNITED STATES
SASKATCHEWAN
MONTANA
Scobey
5
FORT PECK INDIAN RESERVATION
Poplar River
2
24
85
16
Glasgow
Wolf Point
Williston
2
Missouri River
Fort Peck Reservoir
24
13
200
22
200S
FIGURE 10
POPLAR RIVER AREA
Saskatchewan Power Corp.
Poplar River Unit #1
Air Quality Sampling Sites
10 5 0 10 20 30 40 50
Statute Miles

Background Stations

1. Montana operates a background sampler at the Smith Ranch near Ovando in western Montana and was operating a second background monitor at the Lindsay-Weilgosh site in eastern Montana until a February 1982 wind storm destroyed it.
2. The Smith Ranch site is located in the sparsely populated upper Blackfoot Valley. The entire area is used almost exclusively for hay production and livestock grazing. The 1981 geometric mean (16 ug/m^3) and highest 24-hour reading (98 ug/m^3) are both very low, indicating the site is serving its purpose.
3. In the 1981 Network Review the AQB recommended that the Lindsay-Weilgosh site be moved to a location in the vicinity of Winnett, Montana. After the Lindsay site was destroyed by a wind storm the AQB terminated all sampling at that location and began searching for a new eastern Montana background site near Winnett. In June of 1982, the Bureau of Land Management terminated TSP sampling at a location near Jordan, Montana (figure 11). Since the BLM will allow the AQB to utilize their equipment and the site meets almost all of the requirements established for the Winnett site, the AQB decided to take over the site. The only drawback to this location is a small seam of lignite coal which lies under the area. However, the seam is only four feet thick and unlikely to be of any commercial value. The AQB will operate the monitor as a long-term background station.

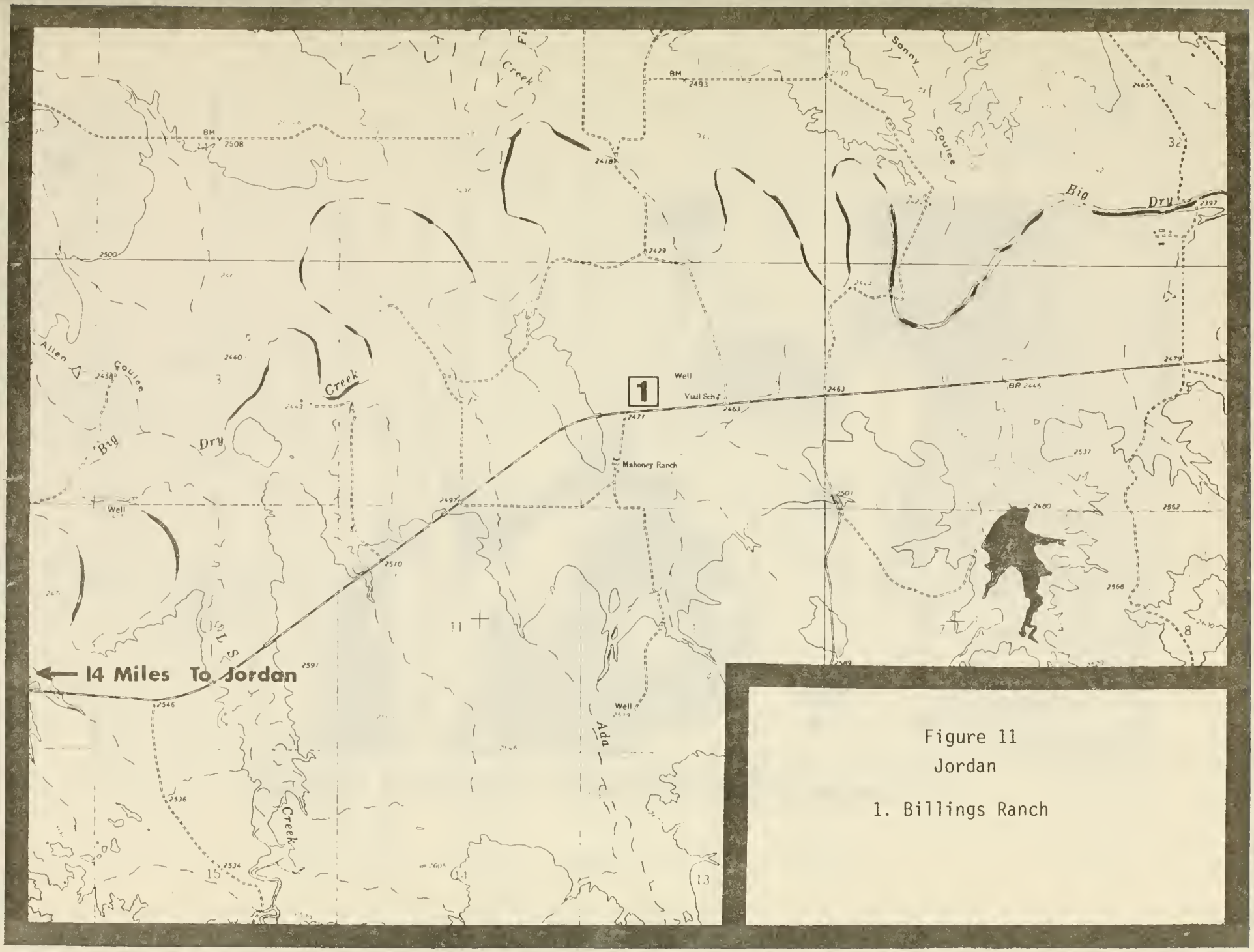
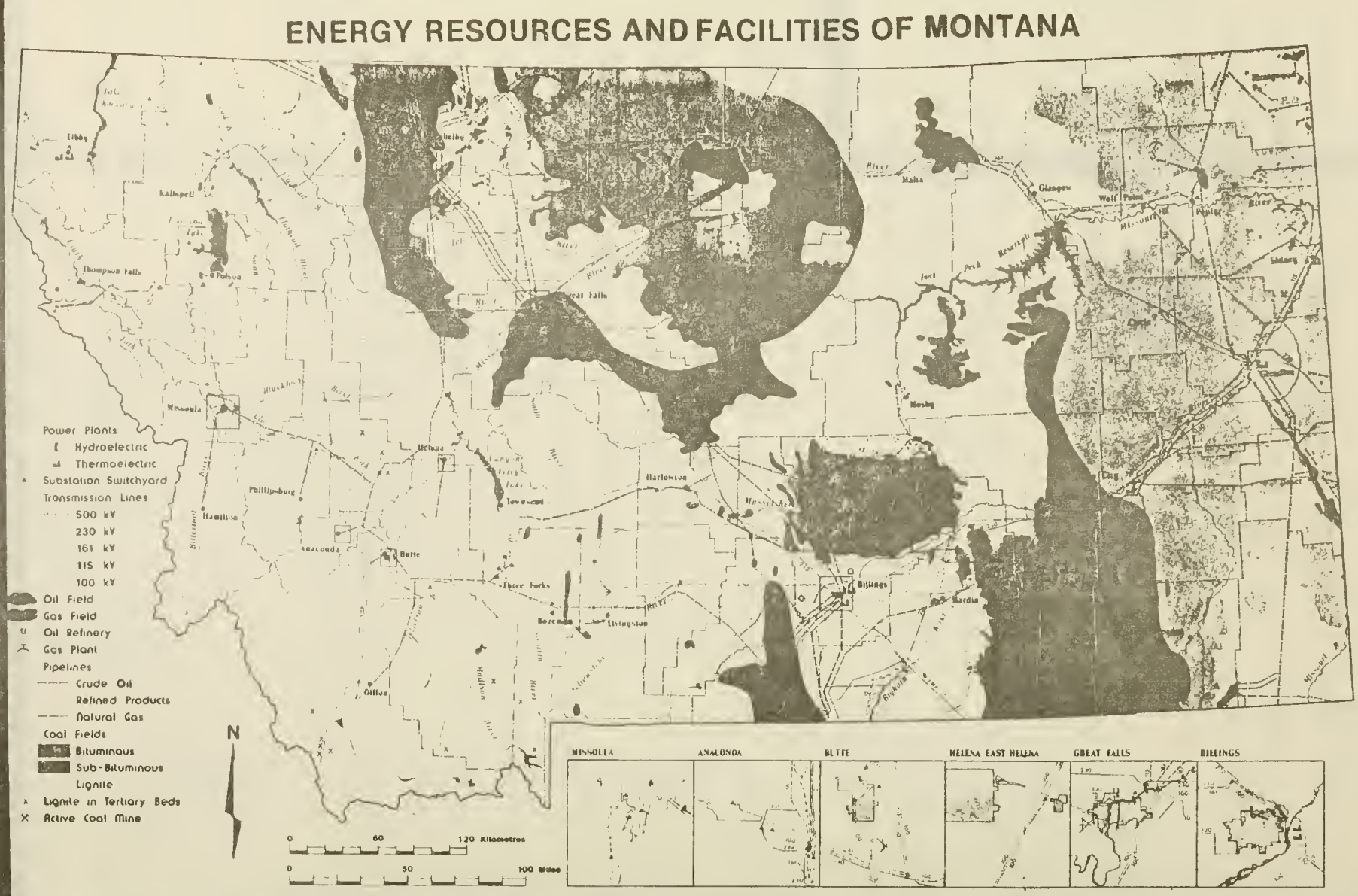


Figure 11
Jordan

1. Billings Ranch

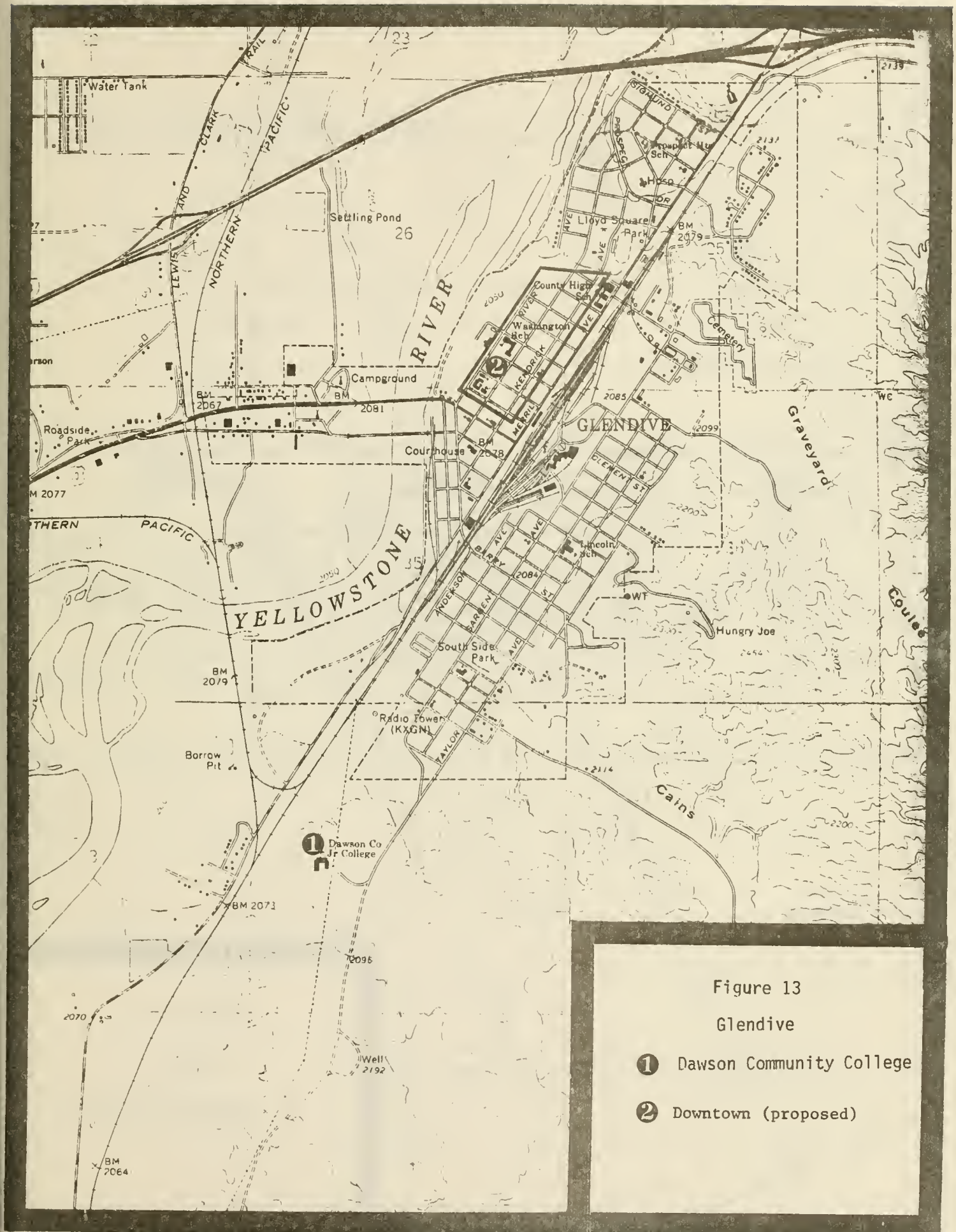
Figure 12


ENERGY RESOURCES AND FACILITIES OF MONTANA
Power Plants
Hydroelectric
Thermoelectric
Substation Switchyard
Transmission Lines
500 kV
230 kV
161 kV
115 kV
100 kV
Oil Field
Gas Field
Oil Refinery
Gas Plant
Pipelines
Crude Oil
Refined Products
Natural Gas
Coal Fields
Bituminous
Sub-Bituminous
Lignite
Lignite in Tertiary Beds
Active Coal Mine
N
0 60 120 Kilometres
0 50 100 Miles
MISSOULA
ANACONDA
BUTTE
HELENA EAST HELENA
GREAT FALLS
BILLINGS

Selected Eastern Montana Cities

1. In the 1979 and 1980 Network Reviews, the AQB proposed that total suspended particulate sampling be conducted in several eastern Montana cities. These cities included: Lewistown, Havre, Miles City and Glendive. The sites were to fill a geographical data void and to establish a TSP baseline for eastern Montana's larger communities. Now that two full years of data have been collected, the AQB recommends the following changes to the eastern Montana network.
2. The Glendive site is located at Dawson Community College. In the 1981 Network Review the AQB suggested that the site be moved into the city proper. Since the college is upwind and high above the city of Glendive, the AQB believes it is presently functioning as a background station. In 1981, the geometric mean was very low at 23 ug/m^3. The AQB reaffirms its recommendation to move the site to an area near Kendrick Avenue between the western leg of business I-94 and the county high school.
3. The Miles City site is located on top of the PCA Building and registered a geometric mean for TSP in 1981 of 52 ug/m^3. The AQB recommends the site be operated for at least one additional year.
4. As stated in the 1981 Network Review, the AQB continues to recommend a new particulate site located in Sidney, Montana. Sidney has a population of almost 6,000 people and is experiencing a boom as a result of the oil and gas industry. The AQB suggests a location near the center of the city but east of Central Avenue.

5. During 1981, the annual geometric mean for TSP at the Havre site was 59 ug/m^3. Since this concentration is very close to the federal secondary standard, the AQB will continue to operate the site for another year.
6. The Lewistown high volume sampler operated less than 50 percent of the time in 1981 due to operator problems. In order to obtain a more complete data set the AQB recommends this site be operated for another year.
7. In 1977, the Colstrip area was designated non-attainment for TSP based on a Montana Power Company site located in the town of Colstrip. In an effort to track the non-attainment status of this community, the AQB will rely on a new Montana Power Company site which became operational in mid-1982 and is located within the community of Colstrip.
8. Yellowstone County operates a high volume sampler at the Laurel Junior High School. The 1981 geometric mean for TSP at the site was 39 ug/m^3. Based on the low concentrations, the AQB recommends the termination of this site. However, since the Yellowstone County Air Pollution Control Agency wishes to continue to operate this site, the AQB will concur.


Water Tank
CLARK
TRAIL
LEWIS AND
NORTHERN
PACIFIC
Settling Pond
26
23
RIVER
YELLOWSTONE
Campground
BM 2081
BM 2067
Roadside Park
Courthouse
BM 2078
GLENDIVE
County High Sch
Washington Sch
Lloyd Square Park
BM 2079
Cemetery
Graveyard
Coulee
Lincoln Sch
Hungry Joe
South Side Park
Radio Tower (KXGN)
Borrow Pit
Dawson Co Jr College
BM 2073
BM 2064
Well
Cains
Figure 13
Glendive
1 Dawson Community College
2 Downtown (proposed)

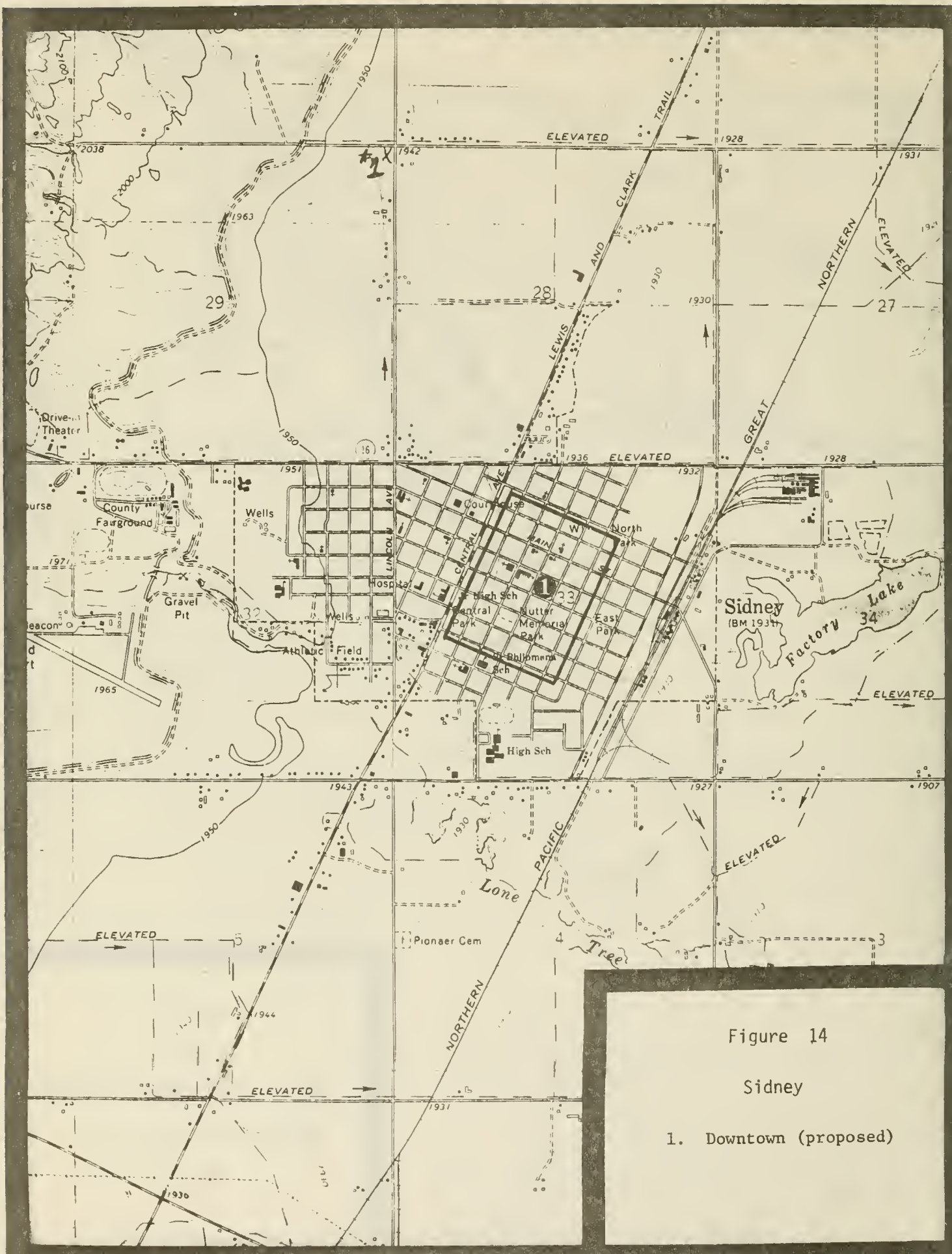


Figure 14

Sidney

1. Downtown (proposed)

Libby, Thompson Falls, and Hamilton

1. In conjunction with the 1981 Network Review, the AQB performed a detailed analysis of Libby particulate concentrations. The AQB still considers that analysis to be applicable and the recommendations sound. Therefore, the AQB continues to recommend an additional high volume sampler in the downtown area of Libby. The preferred location is north of Ninth Street and at least one but not more than three blocks east or west of California Avenue.

   During 1981 Libby continued to record the highest TSP concentrations in the state with an annual geometric mean of 120 ug/m^3. In light of these high readings, the AQB is also recommending a small chemical mass balance study in conjunction with particle sizing to better define the major emission sources influencing the city.

2. Based on the analysis contained in the 1981 Network Review, the AQB also recommends new sites in Thompson Falls and Hamilton.

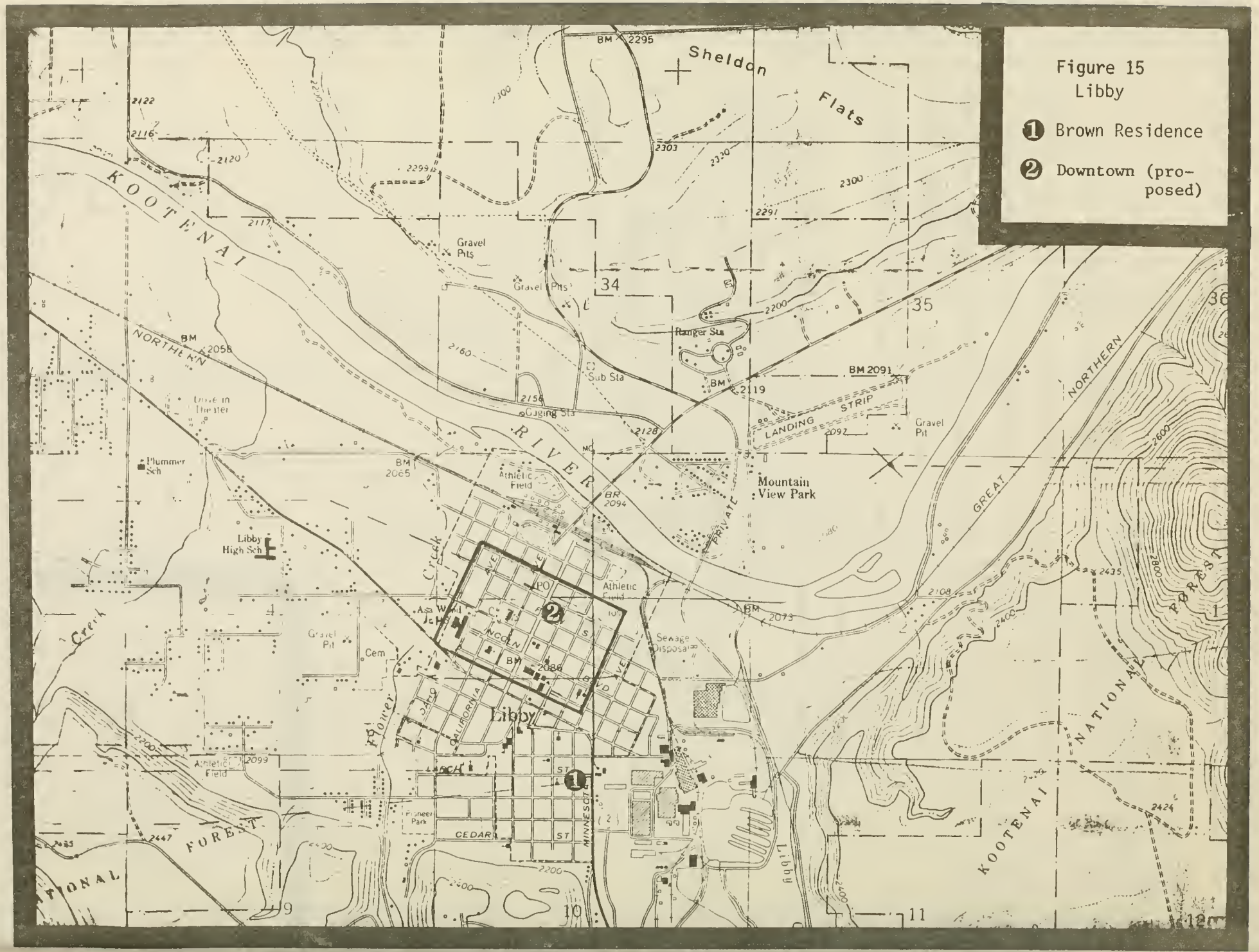


Figure 15
Libby
1 Brown Residence
2 Downtown (proposed)
Sheldon Flats
KOOTENAI
NORTHERN
RIVER
Libby
Libby Creek
Flower Creek
Mountain View Park
Ranger Sta
Sub Sta
Gaging Sta
Gravel Pits
Gravel Pit
Athletic Field
Libby High Sch
Plummer Sch
Sewage Disposal
Cem
Pioneer Park
LANDING STRIP
GREAT NORTHERN RAILWAY
KOOTENAI NATIONAL FOREST
LINCOLN BLVD
CALIFORNIA AVE
MINNESOTA AVE
CEDAR ST
BM 2295
BM 2058
BM 2065
BM 2091
BM 2119
BM 2073
BM 2086
BR 2094
Athletic Field 2099
2122
2116
2120
2117
2160
2158
2128
2092
2108
2435
2424
2447
2200
2300
2303
2291
2400
2600
2800
34
35
36
1
2
4
9
10
11
12

Miscellaneous Source-Oriented Sites

1. The Tierney Residence site in Ramsay and the Thomas Ranch near Decker were both permanently shut down in 1981, as specified in the 1981 Network Review.
2. The Champion Packaging Division sites HW#1 and HW#2 exhibited substantial reductions during 1981. The annual geometric mean decreased 24 percent at both sites. However, the AQB recommends that both sites continue to be operated in order to track plant emissions of TSP and sulfates. These samplers are owned by the Champion Packaging Division of Champion International and operated by the Missoula County Health Department. Both units are equipped with rotometer for flow indication and should be refitted with transducers by June of 1983.

Flathead Valley

1. The AQB is conducting a comprehensive monitoring effort in the Flathead Valley as part of the Flathead Basin Environmental Impact Study. The study is designed to establish environmental baselines and to determine the impact of coal development just over the Canadian Border on the North Fork of the Flathead River. In addition to an extensive TSP sampling network, dichotomous samplers are located at six sites and nephelometers are operated at two locations. The Flathead Basin Environmental Impact Study is in its final stages and will officially terminate in July of 1983.

2. TSP has been monitored in Columbia Falls at the Anders residence for many years. In 1978, Columbia Falls was designated non-attainment for TSP based on data from this site. A subsequent microinventory performed by PEDCo ENVIRONMENTAL, INC. identified fugitive dust off paved and unpaved streets as accounting for over 90 percent of the TSP at this site. A paving project involving Nucleus Avenue, the main street of Columbia Falls, was completed in September of 1981. In 1981 the geometric mean for TSP at the Anders site remained high at 108 ug/m^3. The AQB believes that the continued high readings during 1981 were caused by construction activity and significant improvement will be noted during 1982. Table 7 below describes 1981 TSP data in comparison with 1980 data and construction activity. The table suggests that prior to the start of construction in April of 1981, 1981 levels were higher than 1980. This relationship continued through the summer probably due to construction. However, after the project was completed in September of 1981, levels were much lower than during the same time in 1980. The AQB will continue to operate the Anders Residence site for SIP tracking.

TABLE 7

COLUMBIA FALLS, ANDERS RESIDENCE

TOTAL SUSPENDED PARTICULATE

ug/m^3

	1980	1981	(construction year)
January	83	91	
February	48	146	Preconstruction
March	108	157	
Arith. Mean	80	131	
April	139	150	
May	73	122	
June	82	108	
July	189	319	Construction
August	131	167	
September	175	179	
Arith. Mean	132	174	
October	241	144	
November	104	113	Post construction
December	159	74	
Arith. Mean	168	110	

3. The NAAC site is located outside of Columbia Falls in a forest opening approximately 0.5 miles north of the Anaconda Aluminum Plant. It typically measures low levels of particulate but high levels of sulfates. The annual geometric mean for TSP at this site during 1981 was 25 ug/m^3. The AQB recommends that this site be terminated at the conclusion of the Flathead Study.
4. The Universal Athletics site is located on a roof top one-half block off the main street of Kalispell. The site registered an annual geometric mean for TSP during 1981 of 81 ug/m^3. The highest 24-hour value during 1981 was 211 ug/m^3.

As a result of the analysis performed during the 1981 Network Review, the AQB recommends that this site be operated and that an additional site be established at least four blocks east of Main and four blocks south of the Burlington Northern tracks. Such a site should help to define the geographical boundaries of high TSP concentrations in Kalispell and to determine the impact of road dust on the Universal Athletic site.

6. In May of 1980 the AQB established a TSP sampling site at the Evergreen Rural Cooperative Building. In the 1981 Network Review the AQB suggested that this site be re-evaluated after more data was available. In 1981 the TSP levels remained low at 53 ug/m^3. The AQB therefore recommends that the site be terminated.
7. As part of the Flathead Basin Study, high volume samplers are being operated at the Glacier International Airport, Polebridge, Whitefish, Bigfork, Swan River, Polson, and Ninepipe Reservoir near Ronan. The AQB recommends that at the conclusion of the study in July of 1983, the Polson site be continued because of the sampling history in the area and its location south of Flathead Lake and that the Polebridge site be operated until the Cabin Creek coal mine is producing. The AQB also recommends that the Whitefish site be operated until another year of data is collected.

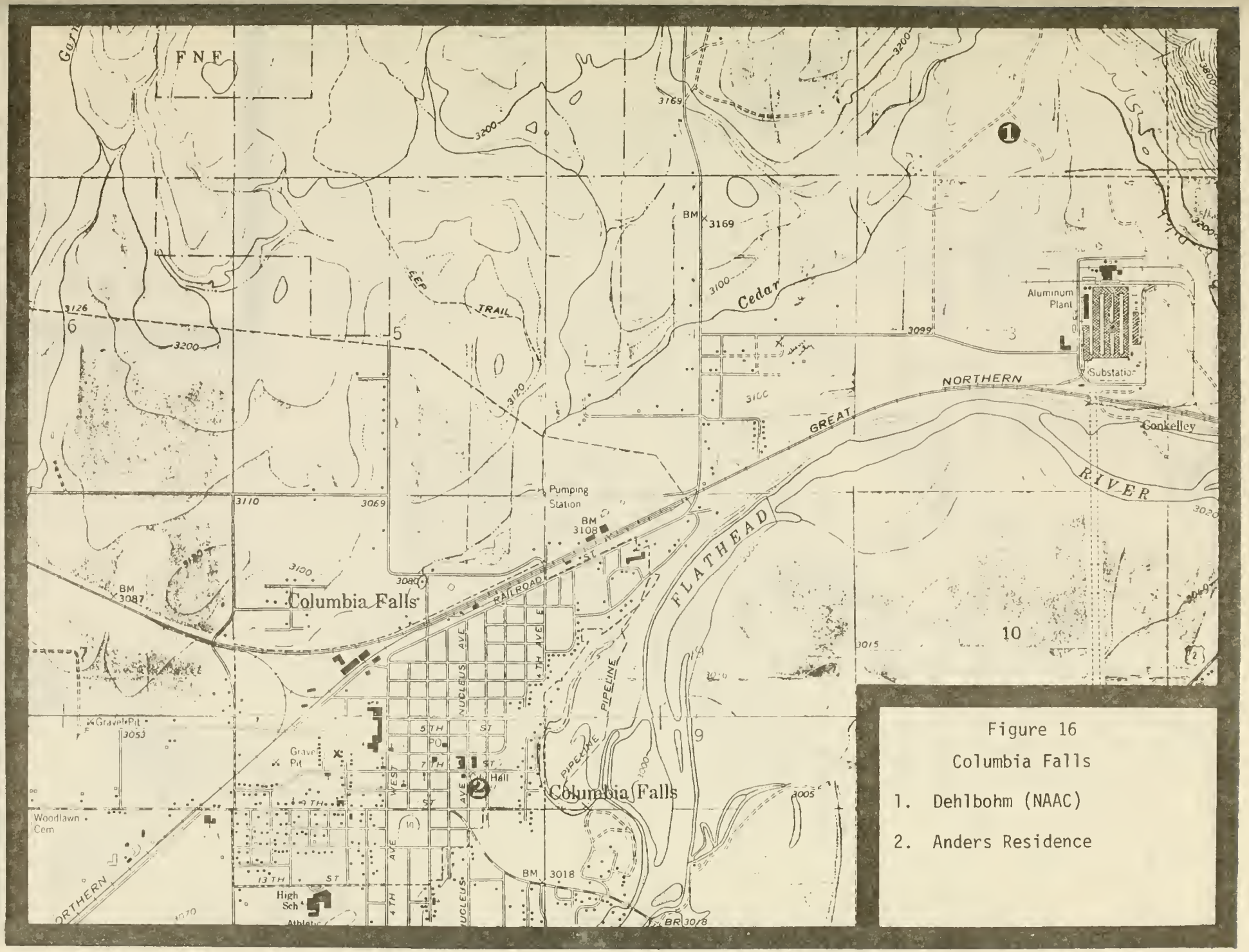


Figure 16

Columbia Falls

1. Dehlbohm (NAAC)
2. Anders Residence

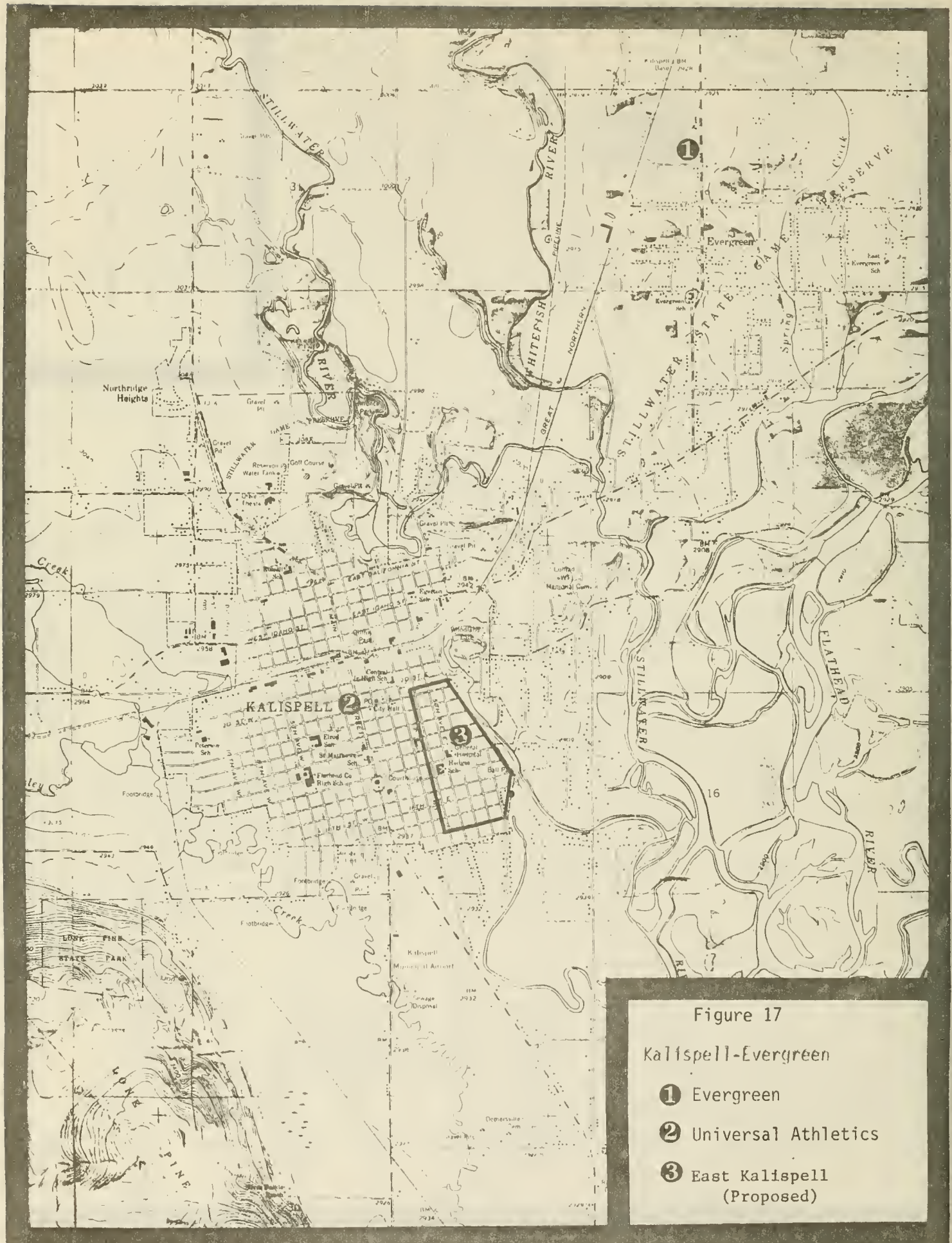


Figure 17

Kalispell-Evergreen

1. Evergreen
2. Universal Athletics
3. East Kalispell (Proposed)

Summary

Although the Air Quality Bureau addressed air quality trends separately in each study area, one significant pattern should be mentioned here. In the mountainous portion of Montana TSP levels declined during 1981. In the western mountains, 27 sites exhibited a decline, five showed increases, and two stayed the same. On the other hand, of the 23 sites located in eastern Montana, 10 showed a decline, 12 increased, and one remained constant.

The Air Quality Bureau speculates that improved dispersion conditions during 1981 and possibly the economic slowdown were responsible for the general decline in particulate levels in western Montana. Eastern Montana generally experiences good dispersion conditions and is therefore somewhat independent of changes in ventilation. On the other hand, even a small improvement in dispersion conditions can have a significant impact on TSP levels in the inversion prone western valleys.

1. Sidney (Figure 14)
2. Glendive (Figure 13)
3. Scobey (3 sites, Figure 10)
4. Miles City, PCA Building
5. Jordan (Figure 11)
6. Decker Coal #2
7. Billings (7 sites, Figure 2)
8. Laurel (2 sites, Figure 2)
9. Lewistown, Downtown
10. Havre, Central Building
11. Bozeman(3 sites, Figure 8)
12. Great Falls (7 sites, Figure 4)
13. East Helena (11 sites, Figure 6)
14. Helena (4 sites, Figure 5)
15. Butte (4 sites, Figure 3)
16. Anaconda (1 site, Figure 9)
17. Ovando, Smith
18. St. Marys
19. Polebridge
20. Whitefish
21. Libby (2 sites, Figure 15)
22. Kalispell (3 sites, Figure 17)
23. Columbia Falls (2 sites, Figure 16)
24. Glacier International Airport
25. West Glacier
26. Bigfork R.S.
27. Swan River, Youth Camp
28. Thompson Falls
29. Polson
30. Ronan Ninepipes
31. Missoula (6 sites, Figure 7)
32. Hamilton

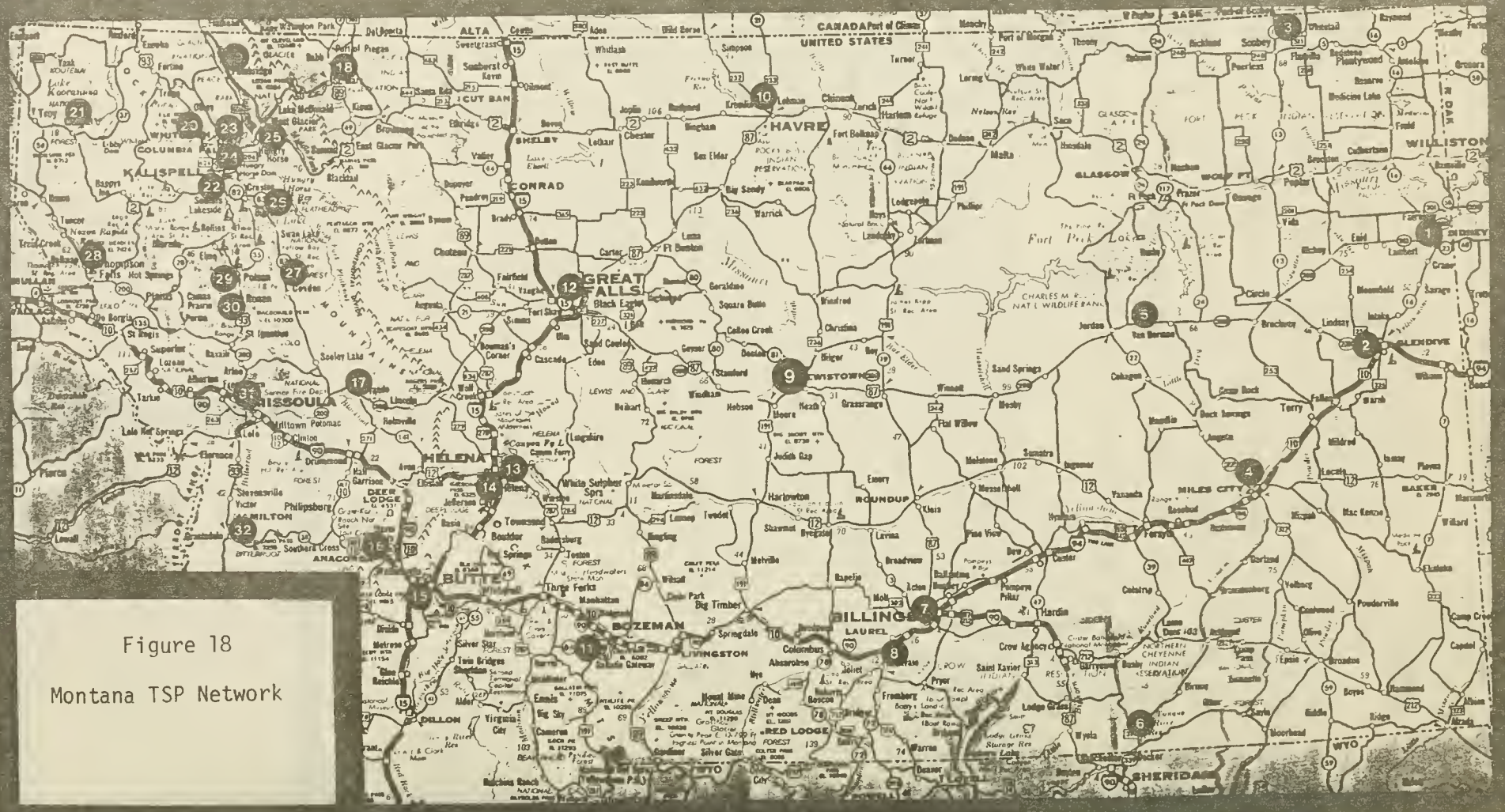


Figure 18

Montana TSP Network

TABLE 8

POINT SOURCE PARTICULATE EMISSION ESTIMATES FOR 1980

Source	Part. Tons/Yr	County	City
West Decker Coal	*2136	Bighorn	Decker
Spring Creek Coal	*2001	Bighorn	Decker
East Decker Coal	*1995	Bighorn	Decker
Westmoreland Resources	*1180	Bighorn	Hardin
Montana Power (Corrette)	989	Yellowstone	Billings
Exxon Co. USA	612	Yellowstone	Billings
Cenex	568	Yellowstone	Laurel
Continental Oil Co.	249	Yellowstone	Billings
Bighorn Calcium	* 240	Bighorn	Warren
Great Western Sugar	114	Yellowstone	Billings
Anaconda Co. Refinery	414	Cascade	Great Falls
Philips Petroleum	116	Cascade	Great Falls
Anaconda Co. Butte Operations	*5144	Silver Bow	Butte
Kaiser Cement	475	Jefferson	Montana City
Stauffer Chemical Co.	410	Silver Bow	Ramsay
Anaconda Co. Smelter**	384	Deer Lodge	Anaconda
ASARCO smelter	310	Lewis&Clark	E. Helena
STANCO General	* 238	Deer Lodge	Anaconda
Pfizer Talc	175	Beaverhead	Dillon
Ideal Basic Industries	* 152	Gallatin	Trident
Louisiana Pacific Corp.	* 139	Powell	Deer Lodge
Cyprus Industrial Minerals	132	Gallatin	Three Forks
Western Energy	*4796	Rosebud	Colstrip
Peabody Coal	*1164	Rosebud	Colstrip
Montana Power Co. 1 & 2	887	Rosebud	Colstrip
Holly Sugar	389	Richland	Sidney
Knife River Coal	* 150	Richland	Savage
Northern Cheyenne Forest Prod.	* 140	Rosebud	Ashland
Montana Dakota Utilities	132	Richland	Sidney
Anaconda Aluminum	1331	Flathead	Columbia Falls
Louisiana Pacific Particleboard	761	Missoula	Missoula
Champion Int. Packaging	756	Missoula	Frenchtown
St. Regis Paper Co.	696	Lincoln	Libby
Missoula White Pine & Sash	* 384	Missoula	Missoula
Stoltz Land & Lumber	* 374	Flathead	Columbia Falls
Champion Int.	287	Missoula	Missoula
Plum Creek Lumber	* 275	Lake	Pablo
Flathead Lumber	224	Lake	Polson
American Timber	* 209	Flathead	Olney
Plum Creek Lumber	199	Flathead	Columbia Falls
Flodin Lumber	* 180	Sanders	Thompson Falls
Plum Creek Lumber	149	Flathead	Kalispell
W. I. Forest Prod. Inc.	* 122	Sanders	Thompson Falls
Louisiana Pacific	* 113	Sanders	Trout Creek
Ksanka Lumber	* 112	Lincoln	Fortine

*Fugitive emissions associated with mining and vehicle traffic are included.
**The plant operated for les than six months

TABLE 9

SUMMARY OF TSP CONCENTRATIONS AT MONTANA SAMPLING LOCATIONS

SITE	1980 Geo. Mean	1980 1-High	1980 2-High	1981 Geo. Mean	1981 1-High	1981 2-High
Libby-Brown Residence	128	306	269	120	444	378
Whitefish-Park	--	--	--	*67	144	128
Kalispell-U.A.	92	296	202	81	211	186
Kalispell-Evergreen	*59	169	138	53	170	159
Polebridge	--	--	--	25	89	62
Flathead-Airport	48	309	232	32	134	103
Columbia Falls-NAAC	25	106	81	25	89	83
Columbia Falls-Anders Res.	99	498	455	108	494	390
Glacier Nat. Park-West	*18	81	74	13	69	59
Glacier Nat. Park-East	*12	49	38	* 6	23	20
Bigfork-Ranger Station	36	134	102	28	109	84
Polson	55	519	177	36	174	111
Ronan-Disney	*71	220	168	--	--	--
Ronan-Ninepipe	*18	42	35	18	142	55
Missoula-HW#1	33	213	171	25	106	96
Missoula-HW#2	33	211	209	25	122	100
Missoula-Courthouse	78	357	286	62	220	216
Missoula-Schilling St.	98	464	444	*102	358	272
Missoula-McLeod Park	101	406	374	*100	146	111
Missoula-Rose Park	79	382	292	56	208	187
Missoula-Lions Park	*82	502	416	--	--	--
Missoula-Boyd Park	--	--	--	*81	195	160
Ovando-Terry Smith	21	130	93	16	98	71
Anaconda-Lincoln School	54	165	154	45	149	142
Anaconda-Hiway Jct.	32	93	83	*19	59	57
Warm Springs	32	158	90	26	161	135
Ramsay-Tierney Res.	33	90	89	35	113	89
Walkerville-Blaine Sch.	*28	63	68	30	85	79
Butte-Dr. Canty	66	322	192	49	245	228
Butte-Hebgen Park	74	252	224	65	263	177
Butte-Greeley Sch.	72	220	209	78	346	247
Butte-Floral Park	64	172	166	--	--	--
Monida-BLM	--	--	--	* 7	28	18
Helena-Capital Courts	*70	244	149	52	248	220
Helena-Sunhaven	--	--	--	*48	108	86
Helena-Valley Bank	*55	156	153	42	250	128
Helena-Cogswell Bldg.	*59	199	163	40	191	121
E. Helena-Padbury	--	--	--	*33	126	108
E. Helena-Dartman	--	--	--	*44	112	107
E. Helena-Hadfield	--	--	--	*80	242	203
E. Helena-Firehall	--	--	--	*81	234	218
E. Helena-Hasties	86	346	160	67	230	209
E. Helena-A&W	67	194	156	55	267	190
E. Helena-Canal	--	--	--	46	406	187
E. Helena-Vollmer	--	--	--	36	180	177
E. Helena-South	--	--	--	*39	115	102
E. Helena-Microwave	--	--	--	25	63	54

*Less than eight months of data

SITE	1980 Geo. Mean	1980 1-High	1980 2-High	1981 Geo. Mean	1981 1-High	1981 2-High
Montana City-School	--	--	--	*73	422	240
Great Falls-Riverview Sch.	*58	199	135	45	141	124
Great Falls-Downtown	*57	138	127	55	200	127
Great Falls-Fire Sta.	72	194	191	69	291	192
Great Falls-Lincoln Sch.	*46	97	96	48	164	128
Great Falls-Kiwanis Park	*36	103	92	43	131	117
Great Falls-Black Eagle	*62	178	148	58	166	142
Great Falls-CCHD	37	198	106	*43	157	87
Bozeman-Traphagen	36	117	115	25	69	60
Bozeman-MSU Housing	*58	179	172	57	398	350
Bozeman-Whittier Sch.	--	--	--	*56	89	74
Bozeman-East Main	*102	337	281	68	246	194
Havre-Central Bldg.	*49	124	117	59	162	145
Lewistown-Downtown	*58	144	142	*62	130	116
Laurel-Jr. High	48	195	179	39	126	83
Laurel-New Farm	--	--	--	43	142	134
Billings-KGHL	48	133	128	47	171	160
Billings-Grand Ave.	72	214	173	72	165	157
Billings-Central Ave.	*61	215	211	--	--	--
Billings-City Hall	74	166	150	69	182	155
Billings-Taft Sch.	*72	146	134	64	271	234
Billings-Lockwood	*39	172	135	47	148	102
Billings-Bench Sch.	57	180	130	--	--	--
Malta/BLM	--	--	--	*14	27	20
Scobey-Engberg	*17	93	86	--	--	--
Scobey-Border	17	116	115	28	1358	637
Scobey-Richardson	21	106	102	*34	452	82
Scobey-Hanrahan	*14	37	33	23	544	294
Ft. Peck-G.O.M.	* 7	15	9	21	465	329
Jordan/BLM	--	--	--	* 9	17	14
Miles City-PCA	*55	158	148	52	145	129
Glendive-Dawson College	*18	68	63	23	180	55
Lindsay-Weilgosh	26	152	115	32	206	176
Plevna/BLM	--	--	--	*24	60	34
Decker-Thomas Ranch	39	139	98	*29	64	59
Decker-Coal #2	--	--	--	*41	95	74

*Less than eight months of data

LEAD (PB)

On October 5, 1978, the EPA promulgated an ambient air quality standard for lead (1.5 ug/m^3 quarterly arithmetic mean). As a criteria pollutant the EPA required monitoring for lead in urbanized areas over 500,000 population, in the vicinity of certain categories of major stationary sources which are known lead emitters, and in areas known to be exceeding the standard. In Montana, two areas were affected by these regulations: the area surrounding the Anaconda Copper smelter in Anaconda and in the vicinity of the ASARCO lead smelter in East Helena.

Anaconda

During July of 1980, a labor strike closed the Anaconda smelter. In September, management announced the permanent closure of the plant. The AQB will continue to conduct lead monitoring in the Anaconda area at the Lincoln School site as long as lead analysis is being done on a routine basis in East Helena. If the new particulate sites described on page 28 are established at Warm Springs and Mill Creek, lead analyses will also be performed there.

East Helena

1. Over the last year and one-half, the AQB established and operated a lead sampling network in the East Helena area as part of the Montana SIP requirements. Table 10 describes the sampling network and Figure 6 shows their geographic location in reference to the ASARCO smelter. The sites were located through the analysis of data from (1) past lead sampling, (2) lead concentrations in snow samples, and (3) dispersion modeling. Figure 19 and Figure 20 are maps of the East Helena area showing (1) isopleths of lead concentations in snow and (2) isopleths of lead concentrations in the air as predicted by a dispersion model performed by ETA through a EPA contract.

TABLE 10

EAST HELENA LEAD SAMPLING NETWORK

Site	Sampling Equipment	Rationale
Vollmer	High vol., low vol	Stack emissions
Canal	High vol., low vol, dichot.	Fugitive and stack emissions
Microwave	High vol, dichot	Stack emissions
South	High vol	Fugitive and stack emissions
A & W	High vol	Mostly fugitive emissions
Hastie Residence	High vol	Mostly fugitive emissions and population exposure
Hadfield, Muffick Fire Hall, and Highway	Co-located high vol, low vol, dichot.	Maximum concentration and population exposure
Valley Bank	High vol	Background
Padbury	High vol	Background
Dartman	High vol	Maximum concentration

Although the results from the two methods differed in many respects, they both show peak concentrations in three areas: (1) near the smelter, (2) in an area approximately 1.5 to 2.0 miles southeast of the smelter, and (3) in an area 1.5 to 1.8 miles south of the smelter. The snow sample data indicated that these peaks were somewhat closer to the smelter than the model predicted. In addition, the snow survey identified a high concentration area north of the smelter through the town of East Helena.

2. The Microwave and South sites were intended to sample the predicted high concentration area south of the plant, while the Vollmer site was a compromise site to sample the predicted southeastern concentration peak. Due to poor access and lack of a power supply in the area, the Vollmer site is approximately 0.5 to 1.0 mile north of the preferred location. The A&W, Hastie residence, Fire Hall, Highway, Dartman, and Hadfield

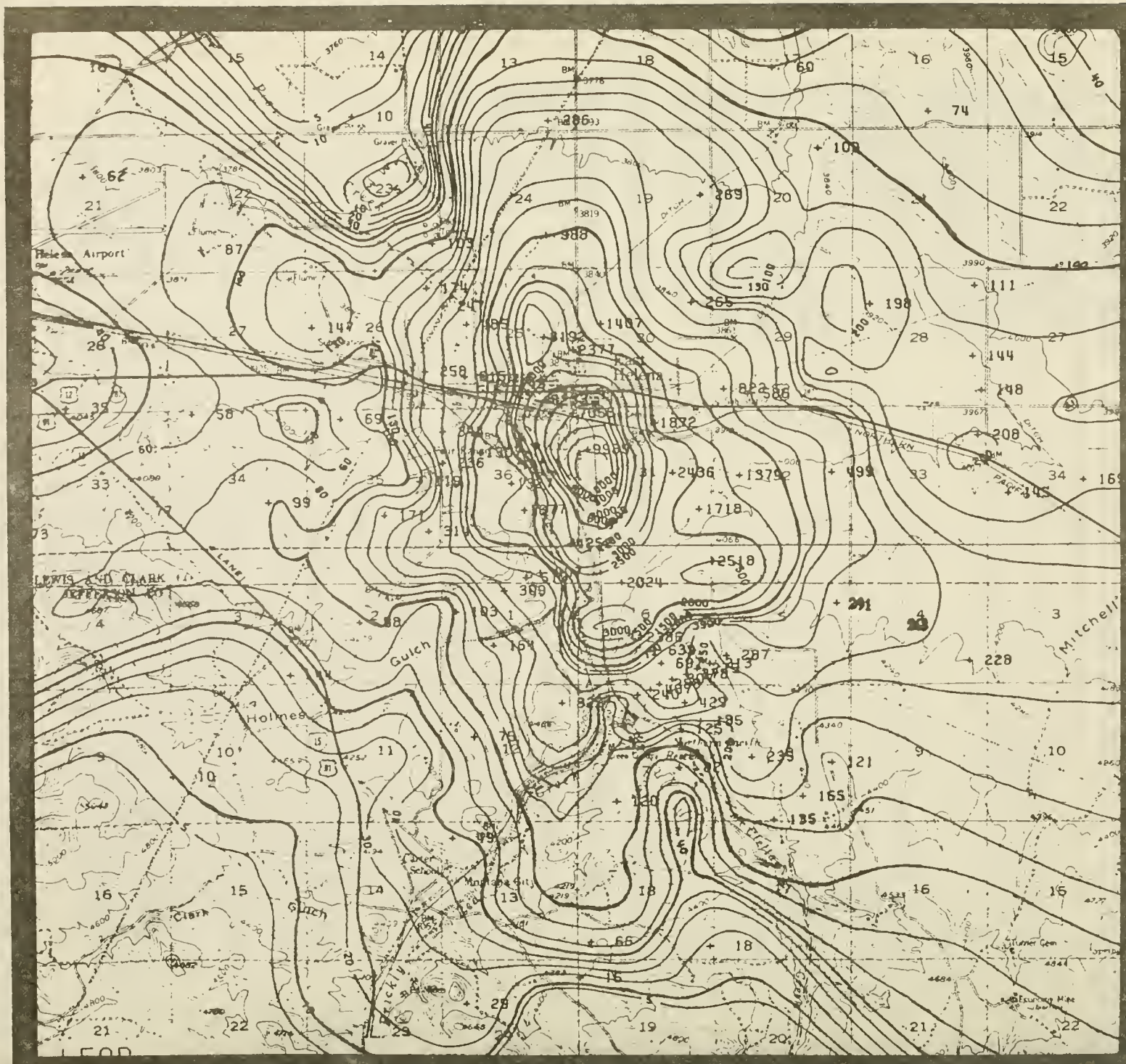


Figure 19

East Helena
Snow Survey

Lead Concentrations
(Micrograms/core)

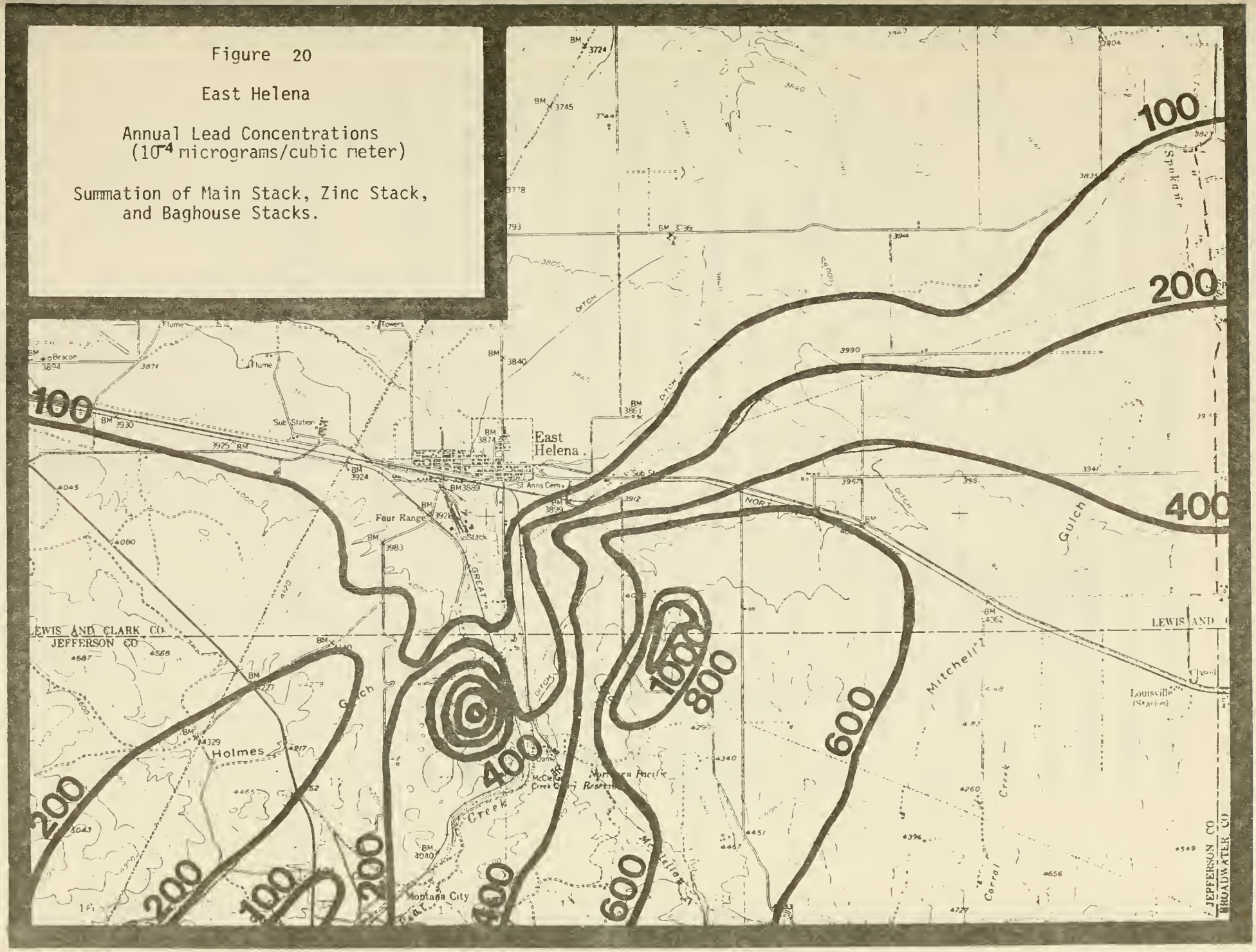
Core=3.65 in^2

Figure 20

East Helena

Annual Lead Concentrations
(10^{-4} micrograms/cubic meter)

Summation of Main Stack, Zinc Stack,
and Baghouse Stacks.



sites were located to determine lead impacts on the population of East Helena, as well as to monitor an area of high lead concentrations as predicted by snow sampling data. The Padbury and Valley Bank sites serve as background since they are located generally upwind of the smelter. The Canal site was chosen based on the results of the dispersion modeling of process and other fugitive emissions.

3. The results of the lead monitoring program (Table 11) indicate that violations of the 1.5 ug/m^3 quarterly standard exist in an area extending north of the ASARCO smelter through East Helena. Quarterly violations were observed at the Hastie residence, East Helena Fire Hall, (terminated due to leasing problems), and the Hadfield residence. The Hastie has shown lead concentrations greater than 1.5 ug/m^3 over its entire five-year history, with a slight reduction occurring in 1980 (see Table 12). If site leasing problems had not developed at the Muffick and Highway sites, violations would probably have occurred there also. The Dartman site north of East Helena and the South site 0.5 miles southeast of the smelter also registered quarterly averages close to the standard. In fact, the Dartman site had a 1.99 ug/m^3 three-month average for September, October and November, 1981.

TABLE 11

1981 EAST HELENA LEAD CONCENTRATIONS

Quarterly Averages (ug/m^3)

Site	Quarter			
	1st	2nd	3rd	4th
Valley Bank	.31	.03	.14	.27*
Montana City	.12*	.08*		
Hastie Residence	3.19	1.60	2.33	2.51
A & W	.51	.40	.42	.49
Vollmer	.66*	.42	.69	1.27
Canal	.91	.76	.77	1.09
Fire Hall	6.19	2.88*		
Microwave		.08	.15	.17
Padbury		.07*	.15	.27
South		1.14*	1.40	.94
Muffick		1.29*		
Hiway			5.33*	
Hadfield			4.98*	2.27
Dartman			3.54*	1.28

*insufficient data to establish a valid quarterly average (Montana criteria)

TABLE 12

1977-1981 HASTIE RESIDENCE - LEAD

Quarterly Lead Concentrations

ug/m^3

Year	Jan.-Mar	April-June	July-Sept.	Oct.-Nov.
1977	4.69	2.76	*2.25	10.80
1978	4.01	4.38	*4.46	4.29
1979	*4.18	2.22	2.44	4.10
1980	2.60	1.45	2.74	2.72
1981	3.19	1.60	2.33	2.51

*In sufficient data to establish a valid quarterly average (Montana criteria)

4. When the original network was designed, the AQB predicted that the Vollmer and Microwave sites would be impacted by lead emissions from the ASARCO stacks. The low concentration of lead registered at these locations indicate stack emissions are not a problem. The AQB also predicted that the other sites, such as Hadfield, Hastie residence, and the Fire Hall, would record higher readings and be influenced to a greater extent by fugitive emissions. The high concentrations observed at these sites, in addition to preliminary results from a chemical mass balance performed by NEA, Inc. of Beaverton, Oregon, indicate that the prediction was correct. Figures 21, 22, and 23 show the contribution from various sources to quarterly lead concentrations gathered by a low volume sampler at the Hadfield and Hastie residence sites. Although the data was obtained from a low volume sampler filter, NEA, Inc. has confirmed that the values are very similar for TSP. The three pie graphs indicate that fugitive road and soil dust, blast furnace emissions during upsets, zinc oxide material and fugitive ore

Figure 21

Pb SOURCE CONTRIBUTIONS, LOW VOLUME SAMPLER
HADFIELD SITE, THIRD QUARTER 1981

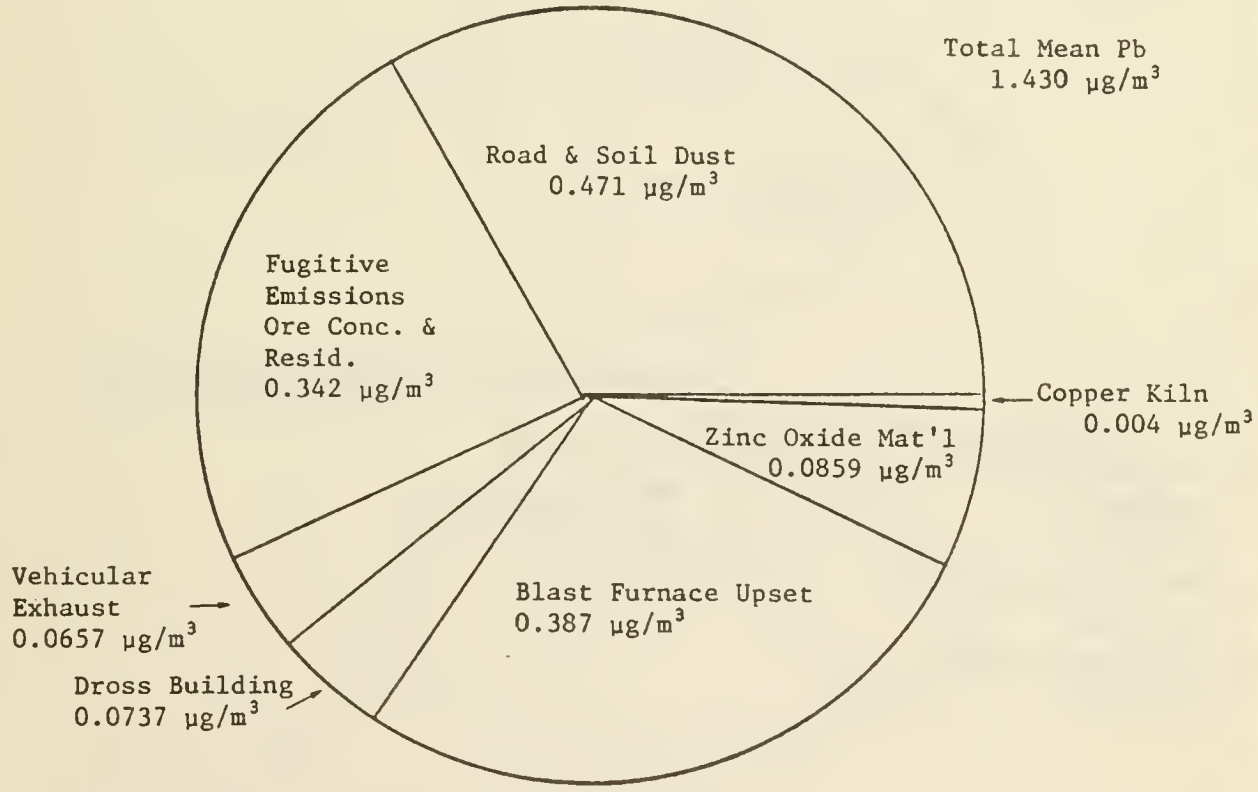


Figure 22

Pb SOURCE CONTRIBUTIONS, LOW VOLUME SAMPLER
HADFIELD SITE, FOURTH QUARTER 1981

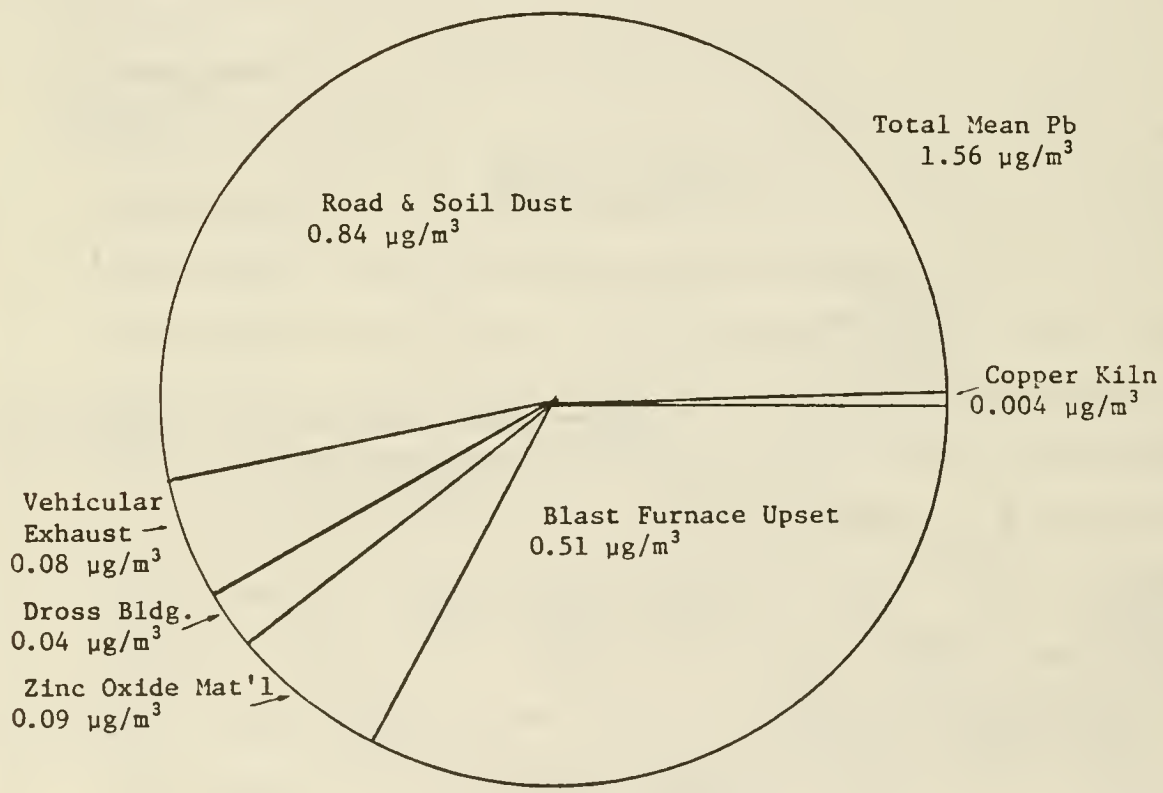
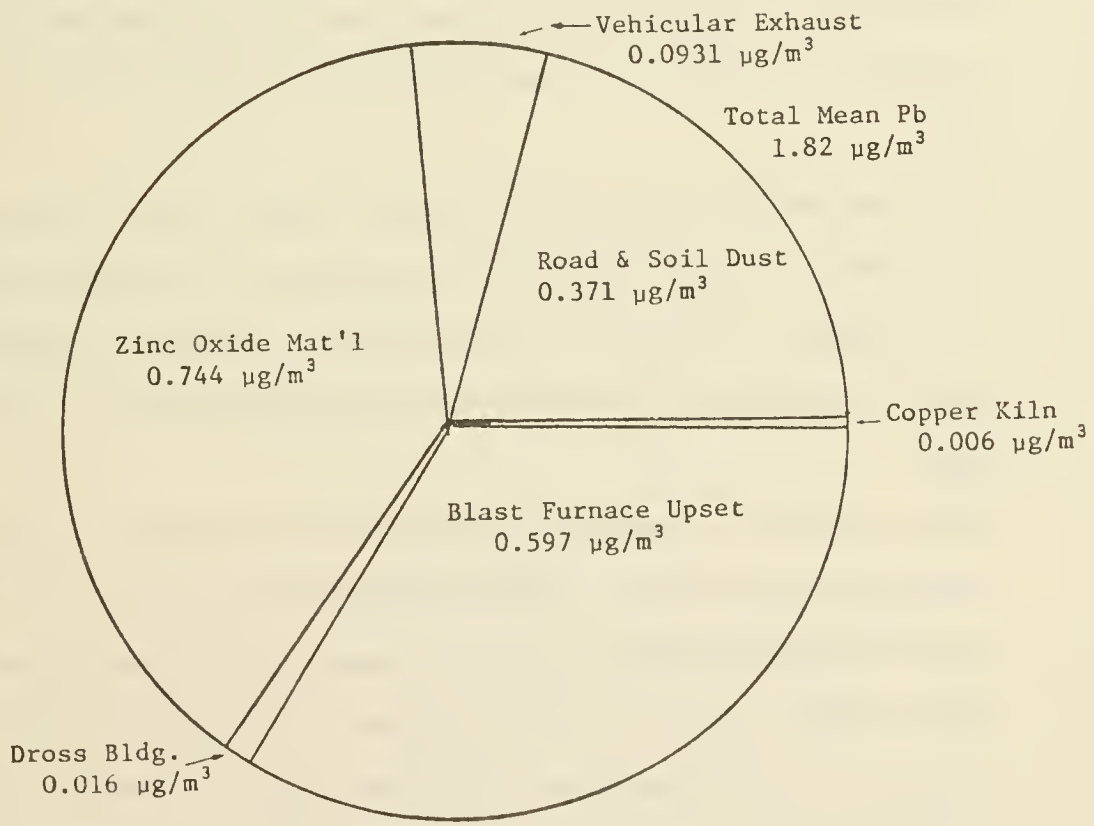


Figure 23

Pb SOURCE CONTRIBUTIONS, LOW VOLUME SAMPLER
HASTIE SITE, FOURTH QUARTER 1981



concentrates are the major sources of lead impacting the samplers. The zinc oxides are ASARCO byproducts which are transferred to the nearby American Chemet Plant for further processing. It should be noted that fugitive emissions off the ore concentrate piles were insignificant in the fourth quarter, after a snow cover was established. NEA, Inc. will be submitting a detailed report covering all aspects of the study in the near future.

5. The development of a lead SIP requires modeling to verify the geographical extent of violations observed during the monitoring project. The AQB contends that additional modeling to meet this requirement is unnecessary for the following reasons:

   a. The extensive lead monitoring network used during 1980 and 1981 has adequately described lead concentrations throughout the East Helena area.

   b. The snow sampling data appears to have reliably predicted areas of high ambient lead concentrations when compared with ambient monitoring data. Since the AQB will continue to monitor at these "hot spots," compliance there should assure compliance over the entire area.

   c. The Valley model conducted by ETA did not perform well in predicting ambient concentrations. A more detailed modeling effort could be initiated with better input data; however, it is questionable whether better results will be attained. In addition, the AQB monitored in all areas predicted to have high lead concentrations and either found them to be in compliance with the ambient standard or will continue to monitor in the associated area.

6. With the preceding information in mind, the AQB recommends that lead sampling be continued at the Dartman, Hadfield, Hastie residence and South sites. The sites are now being operated entirely by AQB staff as SLAM stations and therefore the site identification numbers have been changed.

SULFUR DIOXIDE (SO_2)

The AQB is presently monitoring SO_2 in two areas of the state: Scobey, and the Billings-Laurel area. In July of 1980 the Anaconda Company copper smelter in Anaconda was permanently shut down. As a result, during April of 1981 the AQB shut down all SO_2 monitors in Anaconda.

East Helena

1. The only significant sulfur dioxide emission source in East Helena is the ASARCO lead smelter. The smelter lies on the southern edge of the city of East Helena, about 5 miles east of Helena. Prevailing winds are typically light and from the northwest, west, or southwest.
2. Despite the fact that the 1981 Network Review recommended that the AQB continue to operate an SO_2 monitor at the A & W site on the east edge of East Helena, the site was eliminated during November of 1981 due to low SO_2 concentrations and lack of manpower. In addition, the AQB is convinced that adequate coverage is provided by ASARCO's network. ASARCO operates sites at California Street in Helena, the Water Tank west of the smelter, Kennedy Park in East Helena, the East Station, Kleffner Road, Kleffner Ranch, and Microwave. The AQB will continue to receive data from ASARCO and audit their network.

Scobey

1. The AQB is monitoring SO_2 at two locations near Scobey (Figure 10) as part of the Poplar River Basin Environmental Impact Study. The locations are: the Border site located on the Canadian Border north of Scobey and the Hanrahan site 13 miles northeast of Scobey. The sites were situated to gather baseline data prior to the startup of two 300 megawatt coal-fired power plants at Coronach, Saskatchewan. These sites were chosen as areas of highest SO_2 concentrations based on dispersion modeling performed by an AQB contractor.

2. During 1981 SO_2 concentrations were very low at both sites. The maximum one-hour concentrations were 0.036 ppm at the Border site and 0.051 ppm at the Hanrahan site. These readings occurred during June at the Hanrahan site and September at the Border site. The first 300 megawatt plant started up in October of 1980 and the second is scheduled for operation in November of 1982.
3. Federal funding for the air quality portion of the Poplar River study ceased as of July 1, 1981. The Montana Legislature appropriated sufficient funds to continue SO_2 monitoring in the Scobey area until July 1, 1983. Since any operation of the Scobey sites past this date will require funding from the AQB's general budget, I have included this option on the prioritized list contained in Table 16.

Billings and Laurel

1. Sulfur dioxide monitoring has been conducted in Billings and Laurel since 1974. In 1978, the Laurel area was designated non-attainment for the primary national ambient air quality standard for SO_2. Subsequently, a stipulation was signed between the Department and the major sulfur dioxide emitting industries (see Figures 24 and 26) in the vicinity of Billings and Laurel. The stipulation provided for a one-year study to more fully describe the magnitude and geographical extent of sulfur dioxide concentrations. Another major goal of the study is to identify the relative source contribution from each industry.
2. Due to numerous delays, the study did not get underway until September of 1981. Through a cooperative effort, the affected industries and the AQB designed and installed an entirely new SO_2 sampling network. Figures 24, 25, and 26 more fully describe the network. Rockwell International has been contracted to assist in the operation and auditing of the network.
3. In the 1981 Network Review the AQB described in detail the criteria which were used to select the site locations. In general the sites were selected based on: 1) the geographical distribution of SO_2 sources, 2) a vector analysis of source to site wind directions, and 3) dispersion modeling. Figures 24 and 25 depict the results of the dispersion modeling and vector analysis.
4. A summary of 1981 sulfur dioxide data for Laurel and Billings is presented in Table 13. Only the Taft School, Shawnee Park, and Laurel New Farm sites operated over the entire year. One excursion of the Federal 24-hour sulfur dioxide standard and four excursions of the Montana 24-hour standard were recorded at the Coburn Road site. Sulfur dioxide concentrations at the

North Johnson Lane site exceeded the Montana 24-hour standard once. None of the other sites experienced concentrations over state or federal standards, although the averages for the last four months of 1981 (sites started up in September) at North Johnson Lane, Coburn Road, and Lockwood Park were above the state standard for annual average. North Johnson Lane was also averaging above the federal standard for annual averages.

A review of the data also indicates that late fall and winter are associated with the highest SO_2 concentrations. During spring and summer concentrations are the lowest.

5. The AQB with assistance from Rockwell International will operate this network through September of 1982. At that time the attainment or non-attainment status of Billings and Laurel will be decided. If an SO_2 control plan is necessary, the network will be reassessed in order to provide compliance tracking. If a control plan is not needed, the AQB will recommend that the network be drastically reduced.

   At this writing the Department has decided to initiate a temporary monitoring plan when the Rockwell contract terminates at the end of September, 1982. Since the AQB lacks the manpower to operate all the Billings and Laurel sites, the following actions will be taken:

   a. The Laurel New Farm and the BN sites will be temporarily shut down until all the data can be analyzed and additional modeling performed. Preliminary data suggests that sulfur dioxide levels in the Laurel area will be within standards. If no violations occur and further modeling identifies no new "hot spots" all sulfur dioxide monitoring in the Laurel area will be permanently shut down.

b. The Shawnee Park site east of Billings wil be permanently shut down due to relatively low readings.

c. The AQB will take over from Rockwell the operation of the Lockwood Park, Coburn Road and North Johnson Lane sites due to the high concentrations of sulfur dioxide recorded there. It is anticipated that in the near future some of these sites will be operated by Billings industries.

d. The AQB will continue to operate the Taft School NAMS site.

TABLE 13

1981 BILLINGS/LAUREL SULFUR DIOXIDE DATA
(ppm)

Site	No. of Data Hours	Averaging Time			
		Max 1-hr	Max 3-hr	Max 24-hr	Mean
Taft School	7100	.270	.221	.095	.012
Shawnee Park	6495	.500	.287	.075	.019
Fairgrounds (Metra)	339	.170	.091	.032	.009
No. Johnson Lane	1916	.417	.287	.122	.032
Coburn Road	2077	.410	.311	.147	.029
Lockwood Park	2222	.334	.212	.099	.027
Laurel,BN Railroad	2320	.193	.162	.071	.014
Laurel, New Farm	6242	.133	.098	.036	.008

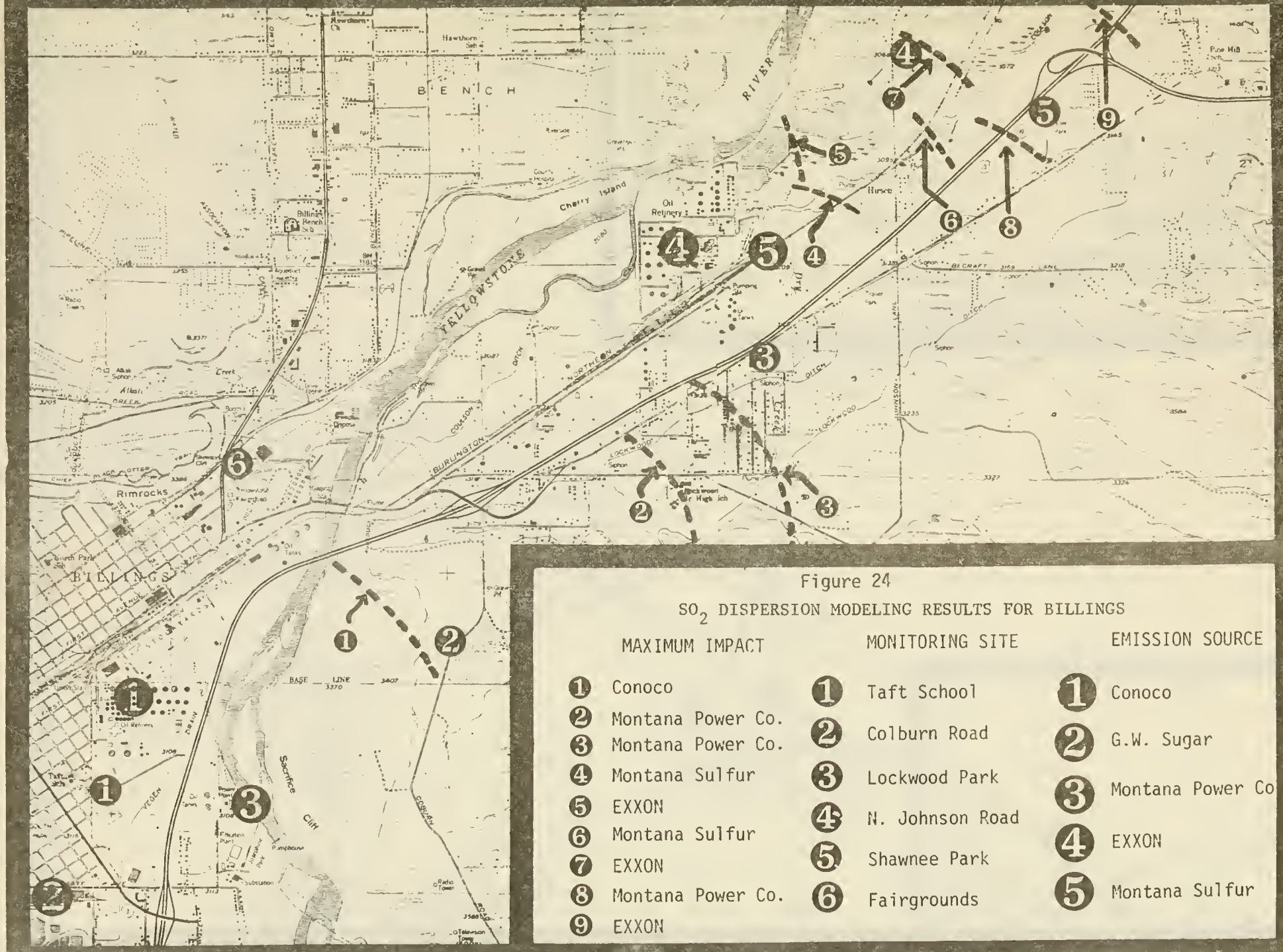


Figure 24

SO_2 DISPERSION MODELING RESULTS FOR BILLINGS

MAXIMUM IMPACT	MONITORING SITE	EMISSION SOURCE
1 Conoco	1 Taft School	1 Conoco
2 Montana Power Co.	2 Colburn Road	2 G.W. Sugar
3 Montana Power Co.	3 Lockwood Park	3 Montana Power Co
4 Montana Sulfur	4 N. Johnson Road	4 EXXON
5 EXXON	5 Shawnee Park	5 Montana Sulfur
6 Montana Sulfur	6 Fairgrounds	
7 EXXON		
8 Montana Power Co.		
9 EXXON		

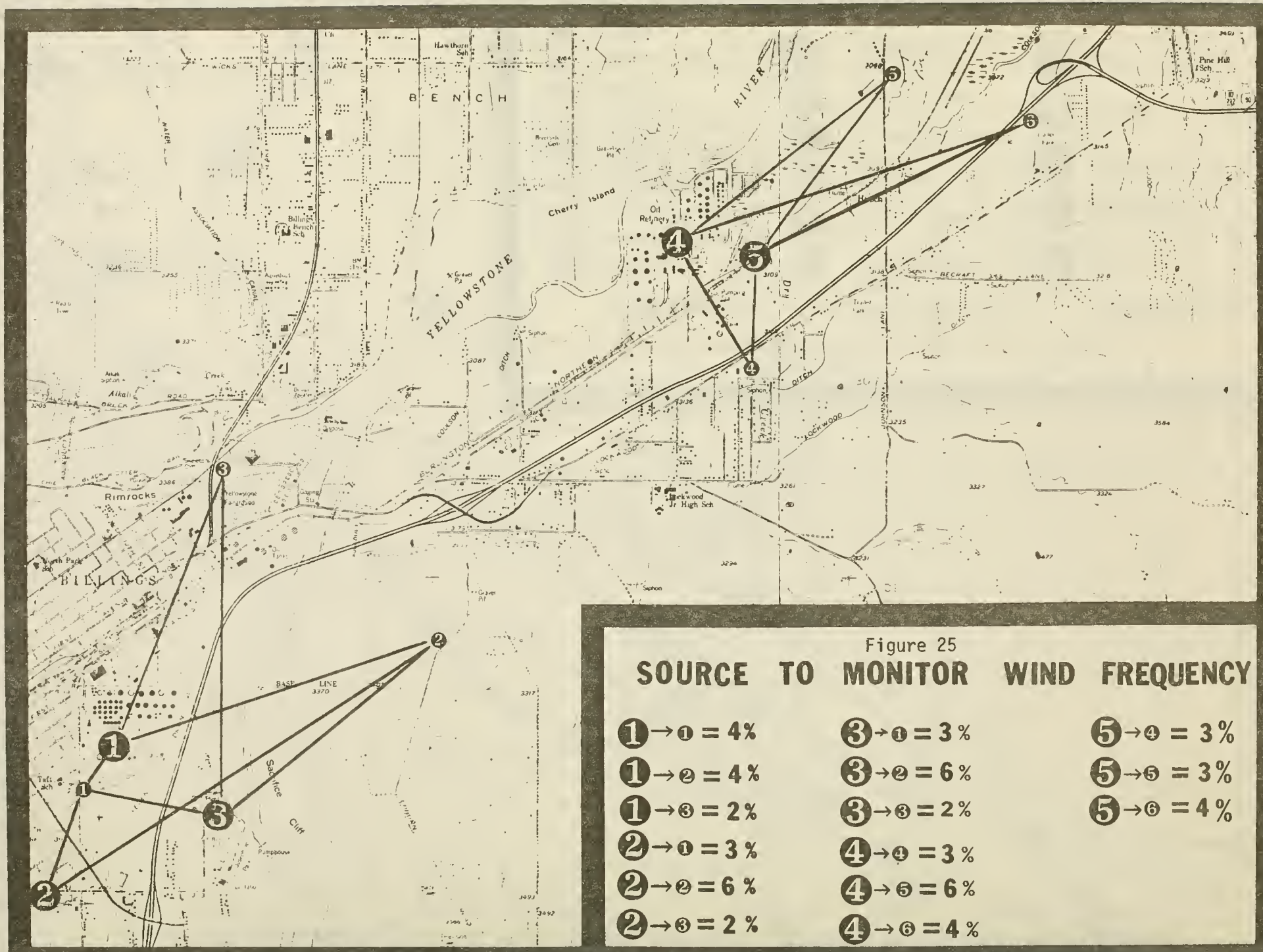


Figure 25

SOURCE TO MONITOR WIND FREQUENCY

1→1 = 4%	3→1 = 3%	5→4 = 3%
1→2 = 4%	3→2 = 6%	5→5 = 3%
1→3 = 2%	3→3 = 2%	5→6 = 4%
2→1 = 3%	4→4 = 3%	
2→2 = 6%	4→5 = 6%	
2→3 = 2%	4→6 = 4%	

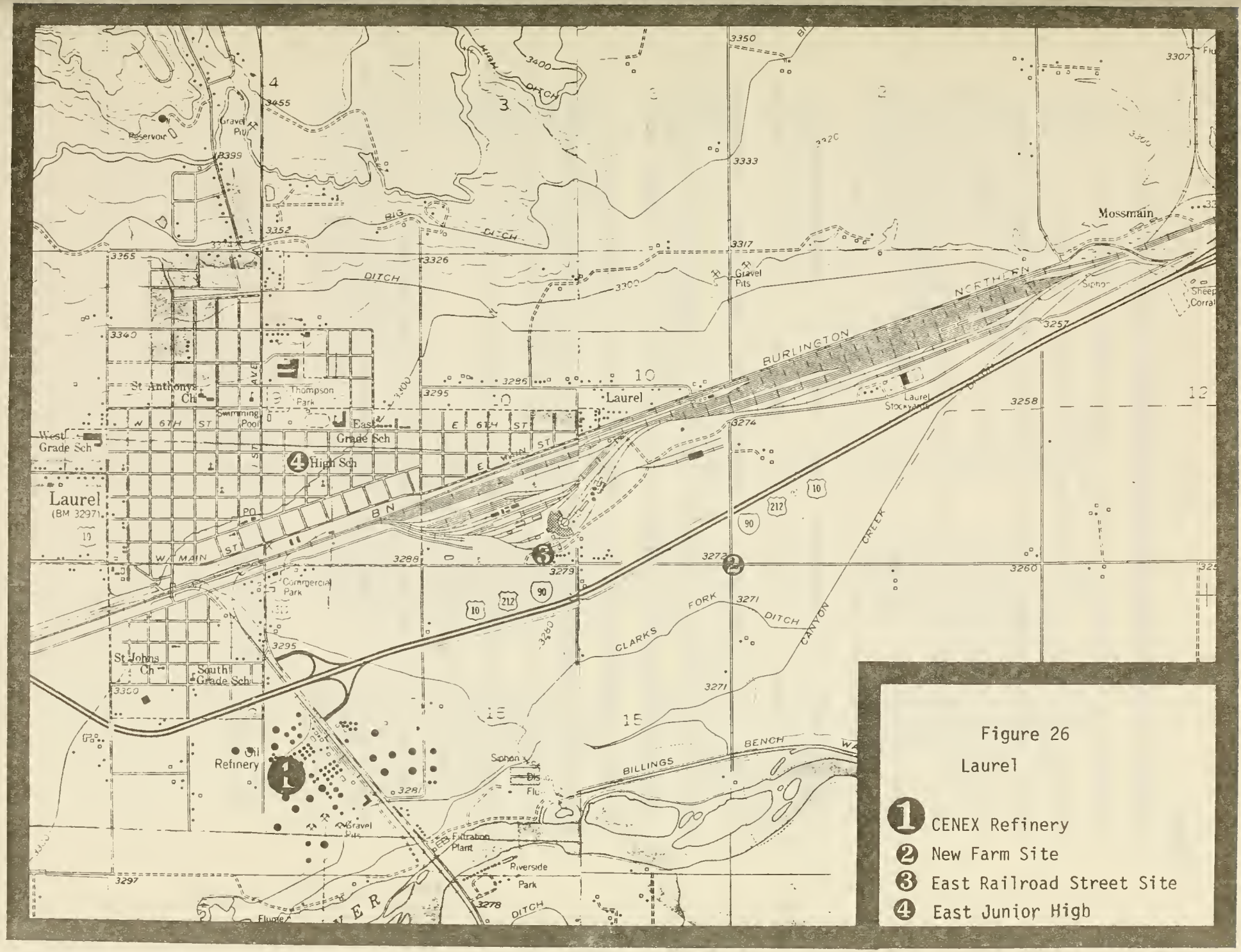


Figure 26

Laurel

1. CENEX Refinery
2. New Farm Site
3. East Railroad Street Site
4. East Junior High

Sidney

1. Sidney is located along the Yellowstone River 25 miles upstream of its confluence with the Missouri River in North Dakota. Sidney lies in the Williston Basin, which is experiencing an economic boom due to oil and natural gas development. As can be seen from Table 14, several large SO_2 sources exist in the area. In addition to these well known sources, there are numerous oil and gas wells scattered over the area which are either directly venting H_2S or flaring it. The AQB has received numerous complaints from area residents concerning H_2S and SO_2 concentrations.
2. In August of 1981 the AQB established a small sulfation plate network in the area. However, due to operator problems, data collection did not get started until June of 1982. In December of 1981 Del Green and Associates completed a contract with the Department to inventory H_2S and SO_2 emissions from wells throughout the Montana portion of the Williston Basin. Due to the sheer number of wells, only about 11 percent of the wells were inventoried. Based on these findings, Del Green and Associates projected 210,000 tons of SO_2 emissions from oil and gas wells in the Williston Basin. The AQB has conducted their own investigations which indicate these projections may be substantially overestimated.

   The AQB will establish a continuous SO_2 monitoring site in or near Sidney by July of 1983 if the data obtained from the sulfation plates demonstrates there is a need.

TABLE 14

POINT SOURCE SULFUR DIOXIDE EMISSION ESTIMATES FOR 1980

Source	SO_2 Tons/Yr	County	City
Exxon Co., USA	10735	Yellowstone	Billings
Farmers' Union CENEX	10380	Yellowstone	Laurel
Montana Power Co. (Corette)	9811	Yellowstone	Billings
Continental Oil Co.	3051	Yellowstone	Billings
Montana Sulfur	2136	Yellowstone	Billings
Great Western Sugar	711	Yellowstone	Billings
Westmoreland Resources	* 57	Big Horn	Hardin
East Decker Coal	* 46	Big Horn	Decker
West Decker Coal	* 46	Big Horn	Decker
Spring Creek Coal	* 17	Big Horn	Decker
Phillips Petroleum	1172	Cascade	Great Falls
Rainbow Resources	200	Glacier	Browning
WESTCO	12	Glacier	Cut Bank
Anaconda Co. Smelter***	126642	Deer Lodge	Anaconda
ASARCO	28740	Lewis & Clark	East Helena
Ideal Basic Industries	130	Gallatin	Trident
Anaconda Co. Butte Operations	* 117	Silver Bow	Butte
Kaiser Cement	44	Jefferson	Montana City
Oil and gas flaring	210000	Williston Basin**	
Montana Dakota Utilities	2192	Richland	Sidney
Shell Oil, gas plant	1278	Richland	Sidney
Perry Petrolane, gas plant	867	Richland	Sidney
Valley County Ind. Park	174	Valley	Glasgow
American Colloid	63	Phillips	Malta
KENCO	55	Roosevelt	Wolf Point
Western Energy Coal	* 46	Rosebud	Colstrip
Peabody Coal	* 17	Rosebud	Colstrip
Anaconda Co. Aluminum	2646	Flathead	Columbia Falls
Champion Int., Packaging Div.	541	Missoula	Frenchtown
W. R. Grace	167	Lincoln	Libby
Burlington Northern tie plant	42	Sanders	Paradise
Stoltz Land and Lumber	37	Ravalli	Darby

*Includes tailpipe emissions from diesel powered vehicles.
**Estimated emissions for oil field gas flaring in the Williston Basin.
***Plant operated less than six months

CARBON MONOXIDE (CO)

Automobile exhaust is the principal source of CO emissions, although some industries also emit CO, and agricultural or forestry burning are contributors in some areas. In some western Montana valleys, residential wood burning is an important source.

The AQB is currently monitoring CO at two locations in Missoula and one each in Great Falls and Billings.

Recently the AQB installed dilution systems at the Great Falls Federal and Billings Metra sites to allow for multipoint calibrations. Similar systems will be installed at the Missoula sites as soon as the necessary equipment is modified and/or purchased.

Billings

1. The Billings downtown area was designated non-attainment for carbon monoxide due to high readings in the past. These readings were taken at the 27th and Montana site but this site had to be removed due to building construction. A new site was established at the Billings Fairgrounds. CO was measured for only four months in 1980 and eleven in 1981. In 1980 an 8-hour high of 5.4 ppm was recorded; in 1981 the high was 8.6 ppm.
2. The Fairgrounds site is located some distance from Exposition Drive due to siting problems. Therefore, the relatively low CO concentrations observed were expected. The Yellowstone County Air Pollution Control agency plans to use data from this site to calibrate a model of Exposition Drive emissions and to thereby provide control strategy tracking. The AQB recommends the continued operation of this site at least until the improvements to Exposition Drive have been completed.
3. In the 1981 Network Review the AQB recommended that a new site be established in the vicinity of 27th and Montana to track downtown CO concentrations. Due to a lack of funding, this action will be postponed until the Exposition Drive site is shut down.

Great Falls

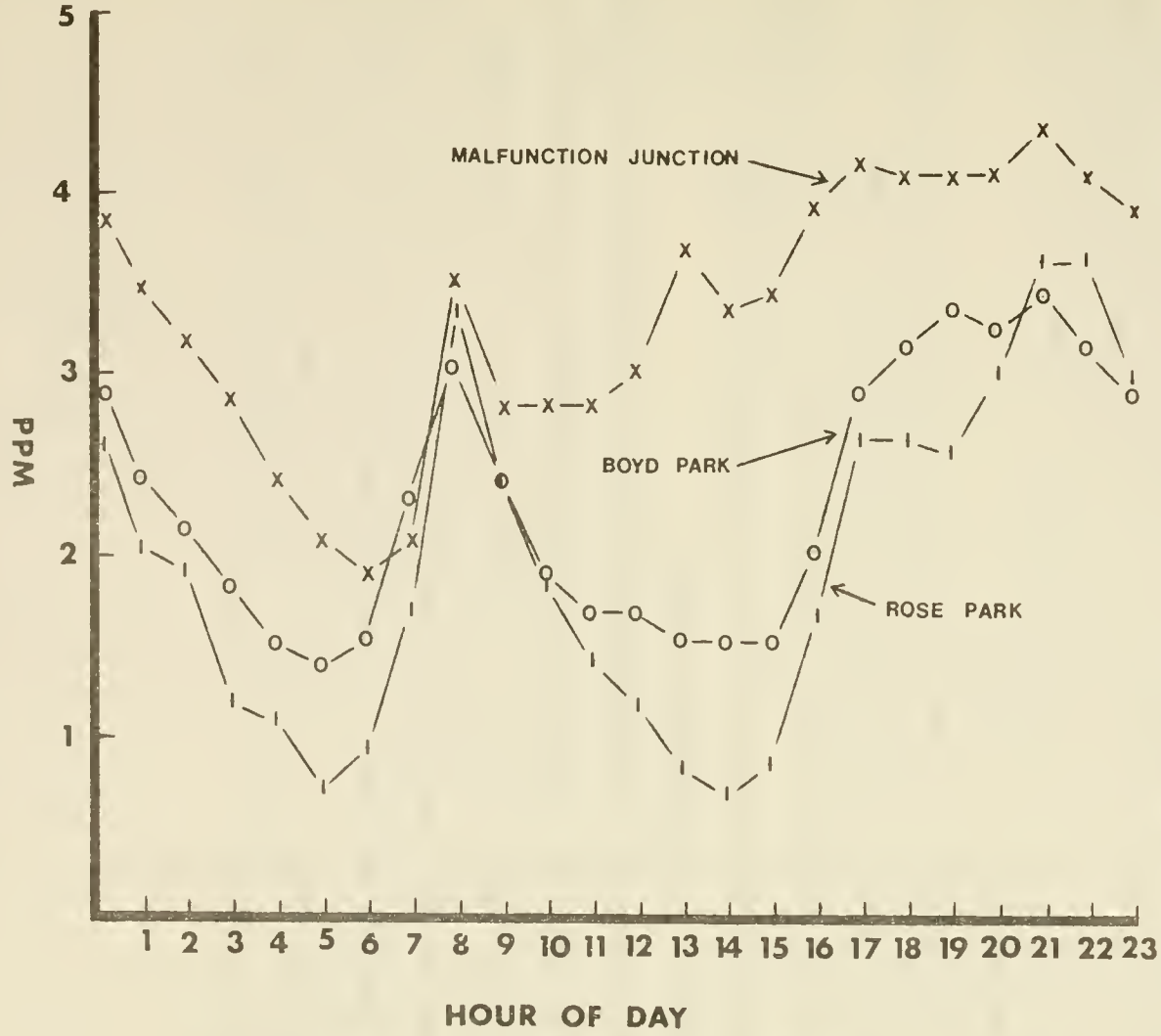
1. In 1979 CO sampling was conducted at 10th Avenue South and 9th Street. This site was used to designate the area non-attainment. Due to a leasing problem, the site had to be relocated a short distance away on 10th Avenue South at the Great Falls Federal Savings and Loan Building.
2. During 1980, CO levels at the Great Falls Federal site exceeded the Montana eight-hour standard of 9 ppm only once. An eight-hour average of 10.1 ppm was registered on December 12. During 1981 there were no exceedances of the 8-hour standard. The highest 8-hour average was 7.8 ppm on January 2, 1981.
3. The Great Falls City-County Planning Board hired PEDCo ENVIRONMENTAL, INC. to evaluate the magnitude and geographical distribution of Great Falls CO levels and to make recommendations as to possible solutions. PEDCo ENVIRONMENTAL INC. operated a CO analyzer on Central Avenue in the downtown area during December of 1981 and January and February of 1982. During the sampling period one exceedance of the 8-hour standard was recorded. An 8-hour average of 15.5 ppm occurred on December 9, 1981. Based on these findings, the central business district of Great Falls remains attainment for CO.
4. PEDCo also performed a dispersion model of the CO emissions in the vicinity of 10th Avenue South. The results of the model indicate that the attainment status is questionable at several intersections along 10th Avenue South. PEDCo ENVIRONMENTAL, INC. points out that the average speed of vehicles on 10th Avenue South is critical. A five mile per hour increase may result in compliance. The AQB believes the completion of the additional lanes on the 10th Avenue South bridge and a traffic light synchronization project will increase the average vehicle speed. The AQB will continue to evaluate alternative modeling strategies.
5. The AQB recommends that the Great Falls Federal site continue to be operated at least for another year.

Missoula

1. Part of Missoula was designated non-attainment for CO based on high concentrations recorded at the Malfunction Junction site. This site is located near the congested intersection of South Avenue, Russell Street, and U.S. 93. Violations of the 8-hour CO standard have also been observed at Lions Park and along Higgins Avenue in the downtown area.
2. Figure 27 shows hourly average CO concentrations at three Missoula locations. In the 1981 Network Review the AQB suggested that inversion conditions during the winter have a greater effect on hourly CO concentrations than traffic volume and wood burning emissions. The 1981 data seems to substantiate this hypothesis.

   During November and December, Missoula is almost always experiencing poor ventilation. The ability of the airshed to disperse pollutants is limited to a relatively slow constant rate with some improvement during the middle of the day. The AQB speculates that during the day the emission rate from automobiles and wood burning are almost equal to the rate of dispersal with the exception of the 8 a.m. traffic peak. However, after about 3 p.m. the emission rate definitely exceeds the dispersion rate and CO levels start to climb. After midnight when emissions are dropping rapidly, the rate of dispersal again exceeds the emissions and concentrations begin to decline.
3. The AQB recommends that the Malfunction Junction site continue to operate for several reasons, including: (1) the very high concentrations observed there;(2) the site's significance in regard to non-attainment designation and tracking; and (3) the large amount of historical data.
4. During July of 1981, the Downtown site was relocated to Boyd Park in a residential area in the south part of Missoula. Despite violations of the 8-hour standard, the Downtown site had to be moved because of opposition to the station by downtown businessmen. An analysis of the violations at this

Figure 27



Carbon Monoxide

HOURLY AVERAGES FOR NOV-DEC 1981

site demonstrated that they were primarily caused by high school students dragging Higgins Avenue on Friday and Saturday nights. The Missoula County Health Department is having a difficult time developing a control plan for this problem.

The Boyd Park location was chosen as an alternative site in order to study CO concentrations in an area with low traffic volume and high residential wood use. During 1981 the highest 8-hour concentration recorded at Boyd park was 8.5 ppm on November 9. The AQB is convinced that during the winter, high CO concentrations exist throughout the Missoula metropolitan area. This site is currently being operated without the capability of a periodic multipoint calibration.

The Department recommends that this site continue to be operated if a dilution system can be obtained and installed by June of 1983. To save money, Missoula County intends to run the site only during the winter. They suggest that high readings are non-existent in the summer and the CO standard is a short-term standard.

5. In accordance with the 1980 Network Review, the Lions Park site was moved to Rose Park. The reason for locating CO monitoring at Rose Park was to monitor CO concentrations in a residential area. In the 1981 Network Review, the AQB suggested that the Boyd Park site is a much better location to accomplish this goal. It is almost entirely free of traffic influence while Rose Park is only one-half block from Brooks Avenue, a major arterial. Therefore, CO monitoring at Rose Park was terminated in January, 1982.

General Recommendations

In 1981, the AQB recommended the purchase of a portable ecolyzer CO monitor. Although the purchase was postponed due to lack of funding, the AQB still considers it a good idea. Such a unit would be used to survey the intersections listed in Table 15 for possible CO violations. The surveys would be performed during very poor dispersion conditions. The 1983 Network Review would then make recommendations based on the surveys. In addition, this unit could be used for responding to public complaints.

TABLE 15

TRAFFIC COUNTS FOR MAJOR MONTANA INTERSECTIONS
Average Daily Traffic

Billings	
Main Street just south of Wicks Lane	25,000*
Main Street just north of State 318	30,400
Main Street just north of 7th Ave. No.	27,583
Exposition Drive just south of 6th Ave. No.	29,500*
Exposition Drive between 2nd and 3rd Ave. No.	17,000*
1st Ave. No. just west of Exposition Dr.	19,000*
Grand Avenue between 1st St. W - Division Street	22,656
State Avenue just west of Orchard Lane	23,640
Grand Avenue between 5th & 6th St. West	23,000*
Grand Avenue just east of 17th St. West	20,000*
Grand Avenue just east of 15th St. West	22,000*
Main Street just south of Milton Road	26,000
24th Street West between Wyoming Ave. & Broadwater	20,000*
Bozeman	
7th & Main	20,500*
Butte	
Amherst & Harrison	19,000*
Front & Utah	18,150
Great Falls	
Central Ave. and Bypass	20,890
10th Ave. So. and 9th Street	30,000*
Helena	
Lyndale, Montana Avenue and Helena Avenue	19,100
Kalispell	
Main Street and Idaho	19,000*
Missoula	
Brooks, South, & Russell (Malfunction Junction)	20,350
Russell and Broadway	21,280
Downtown	18,500*

*estimated

FLUORIDES (F^-)

During 1981 the Montana Board of Health and Environmental Sciences adopted new ambient standards for fluorides. The standards are based on the concentration of fluoride in forage. The standards were set at 50 ppm monthly average and 35 ppm grazing season average.

The AQB is auditing vegetation sampling conducted by the Stauffer Chemical Company and the Anaconda Aluminum Plant to determine compliance. In addition the AQB receives sample splits from both companies and analyzes them in the Department's laboratory.

Because of the insignificant cost, the AQB will continue to use calcium formate papers as fluoride indicators near the Anaconda Aluminum Plant. The use of calcium formate papers has been discontinued at the Grant Kohr Ranch National Historic Park near Deer Lodge and in the vicinity of the Stauffer Chemical Company.

SULFATION RATE

In addition to continuous SO_2 monitors, the AQB will continue to use sulfation plates as indicators of sulfur emissions. The AQB will continue to use sulfation plates around the East Helena ASARCO lead smelter and in Billings and Sidney. During 1981 the use of sulfation plates was terminated at the Grant Kohr Ranch National Historic Park in Deer Lodge and near the Stauffer Chemical Company in Ramsey.

OZONE (O_3)

Ozone in the lower atmosphere generally is formed by reactions of various photochemical substances with hydrocarbons and nitrogen oxides produced by automobiles and some industrial sources, such as refineries. Natural sources of ozone include formation by lightning and transport of stratospheric ozone to lower levels, but concentrations due to these causes typically are very low.

Ozone due to man's activities is a secondary pollutant that requires an accumulation of precursor emissions (hydrocarbons and/or nitrogen oxides), warm, sunny weather, and relatively little ozone removal, for high concentrations to develop. Because several hours are required for ozone formation, and because large accumulations or precursor emissions are most likely in air that travels across a precursor emitting region, maximum concentrations of ozone generally are found five to seven hours after rush hour downwind of the emitting region. Warm temperatures facilitate ozone formation, so high concentrations generally are confined to the warmer months.

During the fall of 1981 the Bureau terminated ozone monitoring at the Shawnee Park site near Billings. With the start of the Billings SO_2 study, the Bureau's Billings operator had insufficient time to operate this site. If money is available, ozone monitoring may be reactivated after the completion of the SO_2 study.

In the 1981 Network Review the AQB recommended a future ozone site located east northeast of Great Falls. Since then the Bureau has received data from the Montana Power Company monitoring site 15 miles east northeast of Great Falls. The AQB will continue to review data from this site and therefore sees no need for a state site in the same area.

Modifications to the Ozone Network

1. By 1984, the Bureau plans to reestablish an SPM monitor between 10 and 40 miles east-northeast of Billings.

NITROGEN DIOXIDE (NO_2)

Nitrogen dioxide is a toxic, corrosive, and highly oxidizing gas formed from oxidation of nitric oxide (NO), a process that typically requires about two hours reaction time. Since the automobile is the primary source of NO, highest concentrations of nitrogen dioxide generally occur downwind of rush hour traffic areas.

With the completion of MAPS, the Bureau terminated all nitrogen dioxide sampling throughout the state with the exception of Billings. A new site was established at the Fairgrounds in Billings; however, the analyzer was shut down due to lack of manpower and will remain shut down until sufficient manpower is available. At that time it may be reestablished at the same location as the proposed ozone monitor.

PRIORITIZATION OF PROPOSED NETWORK MODIFICATIONS

Table 16 presents a prioritized list of proposed modifications to the Montana ambient air monitoring network. The Bureau prioritized this list based on the importance of the changes and the financial costs involved.

The AQB will initiate the proposed modifications starting with item number one and proceeding to item 39 as manpower and money are available. However, the first group of modifications will be completed before each subsequent group is started.

TABLE 16

LIST OF PROPOSED MODIFICATIONS TO THE MONTANA AMBIENT MONITORING NETWORK

*1. Terminate the East Helena A&W site for SO_2 and TSP.

*2. Shut down all East Helena TSP and lead sites except for the Dartman, Hadfield, South and Hastie residence sites.

*3. Operate the Missoula Boyd Park CO monitor only during the colder months.

*4. Terminate fluoride papers near Ramsay.

*5. Shut down the Billings Fairgrounds (Metra) SO_2 monitor.

*6. Indefinitely postpone plans to establish a TSP site near Poly Drive in Billings.

*7. Cancel plans for a new TSP site in downtown Butte.

*8. Cancel plans for new TSP sites at Target Range in Missoula.

*9. Redesignate the East Helena sites (Dartmans, Hadfield, and South) as state-run SLAMS sites for TSP and Pb.

*10. Take over the operation of the BLM Jordan site as an eastern Montana background site.

11. Terminate the Great Falls Kiwanis Park TSP site.

12. Terminate the Great Falls CCHD TSP site.

13. Terminate the Walkerville Blaine School TSP site.

14. Terminate the NAAC TSP site near Columbia Falls.

15. Terminate the Great Falls Lincoln School TSP site.

16. Terminate the Evergreen TSP site near Kalispell.

17. Terminate the Great Falls Riverview School TSP site.

18. Terminate the Swan River TSP site.

19. Terminate the Bigfork TSP site.

20. Terminate the Glacier International Airport TSP site.

21. Terminate the Ninepipes TSP site.

22. Establish another TSP site in the downtown area of Libby.

23. Establish another TSP site on the east side of Kalispell.

24. Establish a new TSP site in Thompson Falls.

25. Move the Billings KGHL TSP site to the Bench School.

26. Move the Billings Lockwood School high volume sampler to Lockwood Park and shut down this site.

27. Move the Dawson College TSP site to the downtown area of Glendive.

28. Establish a new TSP site in western Great Falls.

29. Establish a new TSP site in Sidney.

30. Establish a new TSP site in Missoula near the old Schilling Street location.

31. Establish a new TSP site near the Northside Cemetary in Missoula.

32. Establish a new TSP site in Lolo.

33. Establish a new SO_2 monitoring site in Sidney.

34. Establish a new TSP site in Hamilton.

35. Continue to operate the Scobey monitoring sites.

36. Establish new TSP sites at Grant Creek and East Missoula.

37. Purchase a portable CO monitor.

38. Establish an ozone monitoring site 10-40 miles east northeast of Billings by 1984.

39. Establish a nitrogen dioxide monitoring site 10-40 miles east-northeast of Billings by 1984.

*Already accomplished

RATIONALE FOR SITE DESIGNATIONS

The Bureau's stations are designated either NAMS, SLAMS, or SPM depending on the general purpose of the station and the period of time it is expected to operate. Table 17 lists some of the reasons for which each type of station is operated.

In general, NAMS and SLAMS are intended to operate for long periods of time. Stations established for short-term measurements are normally designated SPM. If it later is decided to maintain the station beyond its originally projected closing date, the station could be redesignated SLAMS.

Table 18 lists the Bureau's SPM stations, their projected closing dates, and the reasons for their operation.

TABLE 17

MAJOR STATION DESCRIPTIONS AND COMPARISONS

Monitoring Station	SLAMS	NAMS	SPM
Purpose	General program monitoring for criteria pollutants. Supplies data for state implementation plan (SIP). Used for emergency episode monitoring.	Sets national policy, obtains long-term trend data, is used in special national studies, and is selected to monitor highest pollution areas which also have high population.	Special and short-term monitoring according to Montana needs. Monitors non-criteria pollutants.
Installation Deadline	January 1, 1983	January 1, 1981	None
Review Frequency	Annual	Each third year	Annual
Relocation Frequency	Relocated or changed only on annual basis if necessary and with EPA approval.	Not to be moved	No restrictions
Data Reporting	Beginning in 1981, annual reports due by July 1st of the following year to EPA Region and headquarters in N. Carolina.	Same	No reports due unless data is used for SIP purposes.
Report Requirements	Detailed summary, including violations of standards.	Same	None

TABLE 18

STATE OF MONTANA, AIR QUALITY BUREAU

SPECIAL PURPOSE MONITORS

Project or Study		Station	Projected Closing Date	Pollutant	Remarks
Flathead Environmental Study		Big Fork	12/82	TSP	These stations are part of the Flathead Environmental Study, which is being conducted to establish environmental baselines and study the impacts of coal development on the Flathead Basin.
		Kalispell Evergreen	12/82	TSP	
		Polebridge		TSP	
		Ninepipes	6/83	TSP	
		Kalispell Airport	12/82	TSP	
		Swan River	12/82	TSP	
		Whitefish	12/83	TSP	
		Polson		TSP	
Poplar River Study		Border Station	6/83	TSP, SO_2	The Scobey stations are designed to determine the effects of the Coronach power plant in Saskatchewan.
		Richardson	6/83	TSP	
		Hanrahan	6/83	TSP, SO_2	
Other Misc.					
	Bozeman	Traphagen Hall	10/82	TSP	Station is operated by MSU for research purposes.
	East Helena	Montana City School		TSP	Complaint Investigation
	Glacier National Park	St. Mary's		TSP	Operated by Park Service and therfore no projected closing dates.
		West Glacier		TSP	

	Glendive	Dawson Community College	10/82	TSP	To collect data in previously unmonitored areas.
	Great Falls	Kiwanis Park	10/82	TSP	"
		Riverview School	10/82	TSP	
	Laurel	Junior High		TSP	Operated by Yellowstone Co.
	Lewistown	Central Lewistown	9/83	TSP	To collect data in previously unmonitored areas.
	Miles City	PCA Building		TSP	"
	Missoula	Hoerner-Waldorf #1	10/83	TSP	Source station to measure effects of Champion Int. Plant
		Hoerner-Waldorf #2	10/83	TSP	
Billings SO_2 Study	Billings	Coburn Road		SO_2	Source assessment and non-attainment determination.
		North Johnson Lane		SO_2	
		Lockwood Park		SO_2	
		Shawnee Park	10/82	SO_2	
	Laurel	BN	10/82	SO_2	" "
CO Studies	Missoula	Boyd Park	4/83	CO	Station to collect data in previously unmonitored area. concentrations

TABLE 19

SAMPLING AND ANALYSIS METHODS

Parameter	Method
TSP - all sites	High Volume Method 40 CFR, Part 50, Appendix B
Pb - all sites	High Volume Method 40 CFR, Part 50, Appendix B
SO_2 - all sites	EQSA-0276-009 "Thermo Electron Model 43 Pulsed Fluorescent SO_2 Analyzer"
CO - all sites	RFCA-0276-008 "Bendix Model 8501-5CA Infrared CO Analyzer"
	RFCA-0381-051 "Dasibi Model 3003 Gas Filter Correlation CC Analyzer"
O_3 - all sites	EQOA-0577-019 "Dasibi Model 1003-AH, 1003-PC, or 1003-RS Ozone Analyzers"
NO_2 - all site	RFNA-0677-021 "Monitor Labs Model 8440E Nitrogen Oxides Analyzer"

TABLE 20

SUMMARY OF PROBE SITING CRITERIA

Pollutant	Scale	Height above Ground, meters	Distance from Supporting Structure, meters Vert.	Horiz.	Other Spacing Criteria
TSP	All	2-15	--	2	1. Should be >20 meters from trees 2. Distance from sampler to obstacle must be at least twice the height the obstacle protrudes above the sampler. 3. Must have unrestricted airflow 270° around the sampler. 4. No furnace or incineration flues should be nearby. 5. Must have minimum spacing from roads. This varies with height of monitor and spatial scale.
SO_2	All	3-15	1	1	1. Should be >20 meters from trees. 2. Distance from inlet probe to obstacle must be at least twice the height the obstacle protrudes above the inlet probe. 3. Must have unrestricted airflow 270° around the inlet probe, or 180° if probe is on the side of a building. 4. No furnace or incineration flues should be nearby.
CO	Micro	$3 \pm 1/2$	1	1	1. Must be >10 meters from intersection and should be at a midblock location. 2. Must be 2-10 meters from edge of nearest traffic lane. 3. Must have unrestricted airflow 180° around the inlet probe.

CO	Middle and Neighborhood	3-15	1	1	1. Must have unrestricted airflow 270° around the inlet probe, or 180° if probe is on the side of a building. 2. Spacing from roads varies with traffic.
O_3	All	3-15	1	1	1. Should be >20 meters from trees. 2. Distance from inlet probe to obstacle must be at least twice the height the obstacle protrudes above the inlet probe. 3. Must have unrestricted airflow 270° around the inlet probe, or 180° if probe is on the side of a building. 4. Spacing from roads varies with traffic.
NO_2	All	3-15	1	1	1. Should be >20 meters from trees. 2. Distance from inlet probe to obstacle must be at least twice the height the obstacle protrudes above the inlet probe. 3. Must have unrestricted airflow 270° around the inlet probe, or 180° if probe is on the side of a building. 4. Spacing from roads varies with traffic.
Pb	Micro	3-15		>2	1. Should be >20 meters from trees. 2. Distance from sampler to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the sampler. 3. Must have unrestricted airflow 270° around the sampler. 4. No furnace or incineration flues should be nearby. 5. Must be 5 to 15 meters from major roadway.

Middle Neighborhood, Urban and regional	2-15	>2	1. Should be >20 meters from trees. 2. Distance from sampler to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the sampler. 3. Must have unrestricted airflow 270° around the sampler. 4. No furnace or incineration flues should be nearby. 5. Spacing from roads varies with traffic.

Separation distance between roadways and stations, meters

Roadway average daily traffic vehicles per day	Micro scale	Middle scale	Neighborhood Urban Regional scale
<10,000	5-15	>15-50	>50
20,000	5-15	>15-75	>75
>40,000	5-15	>15-100	>100

TABLE 21

STATE OF MONTANA, AIR QUALITY BUREAU
AIR MONITORING NETWORK

Station		Saroad Site I.D.	Monitoring Objectives	Spatial Scale	Target Date New station to open	Target Date Existing station to close
I. Total Suspended Particulates (TSP)						
A. National Air Monitoring Stations (NAMS)						
Billings	Taft School	27 0080 062 F01	H,P,S,	N		
	Taft School (co-located)	27 0080 062 F07	H,P,S	N		
Great Falls	Downtown	27 0660 017 G01	H,P	N		
	Downtown (co-located)	27 0660 017 G07	H,P	N		
B. State and Local Air Monitoring stations (SLAMS)						
Anaconda	Lincoln School	27 0020 007 F01	P	N		
Billings	Bench School		P	N	10/82	
	City Hall	27 0080 008 G01	H,P	N		
	City Hall (co-l)	27 0080 028 G07	H,P	N		
	Grand Ave. Sch.	27 0080 009 G01	P	N		
	KGHL	27 0080 007 G01	P,B	N		10/82
	Lockwood School	27 0080 006 F05	P,S	N		5/83
	Lockwood Park	27 0080 065 F05	P,S	N	5/83	
Bozeman	East Main City Building	27 0120 002 F01	H,P	N		
	Whittier School	27 0120 005 F01	H,P	N		
Butte	Blaine School	27 0160 029 F01	P,B	N		10/82
	Dr. Canty	27 0160 019 F01	P	N		
	Greeley School	27 0160 005 F01	H,P,S	N		
	Greeley School (co-located)	27 0160 005 F07	H,P,S	N		
	Hebgen Park	27 0160 018 F01	H,P,S	N		

Columbia Falls						
	Anders Residence	27 0270 005 F01	H,P	N		
	NAAC	27 0480 029 F02	S	N		12/82
East Helena	Hastie Residence	27 0860 002 F02	H,P,S	N		
	Hadfield	27 0860 719 F02	H,P,S	N		
	Hadfield (coll)	27 0860 719 F07	H,P,S	N		
	South	27 0860 716 F02	S	N		
	Dartman	27 0860 722 F02	H,S	N		
Great Falls	Black Eagle P.O.	27 0660 019 G01	H,P,S	N		
	Fire Station	27 0660 009 G01	H,P	N		
	Hospital (CCHD)	27 0660 007 G02	P	N		10/82
	Lincoln School	27 0660 020 G01	P	N		10/82
Havre	Central Havre City Bldg.	27 0700 001 F01	P	N		
Helena	Cogswell Bldg.	27 0720 001 F01	P	N		
	Capital Courts	27 0720 013 G05	P	N		
	Super Save Groc.	27 0720 015 G05	P	N		
Kalispell	Universal Ath.	27 0800 015 F01	P	N		
Laurel	New Farm	27 0840 014 F02	S	N		
Libby	Brown Residence	27 0900 010 F01	P,S	N		
Jordan	Billings Ranch	27 0540 02 F03	B	R	8/82	
Missoula	Courthouse Roof	27 1100 001 G01	H,P	N		
	Courthouse Roof (co-located)	27 1100 001 G07	H,P	N		
	Rose Park	27 1100 020 G01	P	N		
Ovando	Terry Smith Ranch	27 1260 024 F03	B	R		

C. Special Purpose Monitors (SPM)

Bigfork	Bigfork Ranger Station	27 0480 036 F05	P	N		12/82
Bozeman	Traphagen Hall	27 0120 001 F01	P	N		10/82
East Helena	Montana City	27 0760 905 F05	P	N		
Glacier N.P.	St. Marys	27 0570 010 F02	B	R		
	W. Glacier	27 0570 007 F02	B	R		
Glendive	Dawson Comm. College	27 0600 001 F01	B	N		10/82
	Downtown		P	N	10/82	
Great Falls	Kiwanis Park	27 0660 016 F01	P	N		10/82
	Riverview Sch.	27 0660 018 G02	P	N		10/82
	West Great Falls		P	N	5/83	
Hamilton	Downtown		P	N	6/83	
Kalispell	Airport	27 0480 304 F05	P	N		12/82
	East Kalispell		P	N	11/82	
	Evergreen	27 0800 016 F01	P	N		12/82
Laurel	Junior High	27 0840 001 G02	S,P	N		
Lewistown	Central Lewistown	27 0880 002 F01	P	N		
Libby	Downtown		P	N	10/82	
Miles City	PCA Bldg.	27 1040 003 F03	P	N		
Missoula	Hoerner-Waldorf #1	27 1100 015 G02	S	N		
	Hoerner-Waldorf collocated	27 1100 015 G07	S	N		
	Hoerner-Waldorf #2	27 1100 016 G02	S	N		
	Northside Cemetary		P	N	6/83	
	New Schilling St.		P	N	6/83	
	Boyd Park	27 1100 024 G02	P	N		

	East Missoula		P	N	6/84	
	Grant Creek		P	N	6/84	
Polebridge	Flathead Pro.	27 0480 035 F05	B	U		
Polson	Lake Co. (Mary Lozar)	27 0820 010 F05	P	N		
Ronan	Ninepipes	27 0820 012 F05	P	N		6/83
Sidney	Downtown		P	N	11/82	
Swan River	Youth Camp	27 0820 017 F05	B	N		12/82
Scobey	Border Station	27 0340 001 F03	S,B	R		6/83
	Richardson	27 0340 002 F03	B	R		6/83
	Hanrahan	27 0340 004 F03	B	R		6/83
Thompson Falls	Downtown		P	N	6/83	
Whitefish	Memorial Park	27 0480 037 F05	P	N		12/83

II. LEAD (Pb)

A. State and Local Air Monitoring Stations (SLAMS)

East Helena	Hadfield	27 0860 719 F02	H,S,P	N	
	(co-located)	27 0860 719 F07	H,S,P	N	
	Hastie	27 0860 002 F02	H,S,P	N	
	Dartman	27 0860 722 F02	H,S	N	
	South	27 0860 716 F02	S	N	

III. SULFUR DIOXIDE (SO_2)

A. National Air Monitoring Stations (NAMS)

Billings	Taft School	27 0080 062 F01	H, S	N	

B. State and Local Air Monitoring stations (SLAMS)

Laurel	New Farm		H,S	N	10/82

C. Special Purpose Monitors (SPM)

Billings	Coburn Road	27 0080 066 F05	S	N	
	No. Johnson Lane	27 0080 064 F05	S	N	
	Lockwood Park	27 0080 065 F05	S	N	
	Shawnee Park	27 0080 063 F02	S,P	N	10/82
Laurel	B.N.	27 0840 015 F05	S	N	10/82
Scobey	Border Sta.	27 0340 001 F03	S	R	6/83
	Hanrahan	27 0340 004 F03	S	R	6/83

IV. CARBON MONOXIDE (CO)

A. State and local Air Monitoring stations (SLAMS)

Billings	Fairgrounds	27 0080 061 F02	H,P,S	M	
Great Falls	Gt. Falls Fed.	27 0660 021 G02	H,P,S	M	
Missoula	Malf. Jct. SE	27 1080 005 F01	H,P,S	M	

B. Special Purpose Monitors (SPM)

Billings	Downtown		P,S	M	6/83
Missoula	Boyd Park	27 1100 024 G02	P	N	

V. OZONE (O_3)

A. Special Purpose Monitors (SPM)

Billings East Northeast		S	P	6/84

VI. NITROGEN DIOXIDE (NO_2)

A. State and Local Air Monitoring Stations (SLAMS)

Billings	East Northeast	H	U	6/84

Monitoring Objectives:

- H Highest Concentration
- P Population
- S source
- B Background

Spatial Scales:

- Mi Micro
- M Middle
- N Neighborhood
- U Urban
- R Regional

TABLE 22

MONTANA AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Polltant	Montana standard	Federal Primary Standard	Federal Secondary Standard
Total Suspended Particulates	75 ug/m^3 annual average 200 ug/m^3 24-hr average*	75 ug/m^3 annual geometric mean 260 ug/m^3 24-hr average*	60 ug/m^3 annual geometric mean 150 ug/m^3 24-hr average*
Sulfur Dioxide	0.02 ppm annual average 0.10 ppm 24-hr average* 0.50 ppm 1-hour average**	0.03 ppm annual average 0.14 ppm 24-hr average*	0.5 ppm 3-hr average*
Carbon Monoxide	9 ppm 8-hr average* 23 ppm hourly average*	9 ppm 8-hr average* 35 ppm 1-hr average*	9 ppm 8-hr average*
Nitrogen Dioxide	0.05 ppm annual average 0.30 ppm 1-hr average*	0.05 ppm annual average	0.05 ppm annual average
Photochemical Oxidants (ozone)	0.10 hourly average*	0.12 ppm 1- hr average*	0.12 ppm 1-hr average*
Lead	1.5 ug/m^3 90-day average	1.5 ug/m^3 calendar quarter average	0.12 ppm 1-hr average*
Foliar Fluoride	50 ug/g monthly average*** 35 ug/g grazing season average	None	None
Hydrogen Sulfide	0.05 ppm hourly average*	None	None
Settled Particulate (Dustfall)	10 gm/m^2 30-day average	None	None
Visibility	Particle scattering coefficient of 3 x 10^{-5} per meter annual average	None	None

*Not to be exceeded more than once per year
ug/m^3 micrograms pollutant per cubic meter of sampled air
ppm parts pollutant per million parts of sampled air

**Not to be exceeded more than 18 times per year.

***April through September only

TABLE 23

RELATIONSHIP BETWEEN SITING OBJECTIVES AND DATA USES

General Monitoring Objectives	Specific Monitoring Objectives	Data Uses
A. Highest Concentration	1. Determination of Peak Concentrations in urban and Nonurban areas	Judging attainment/maintenance of NAAQS Evaluating progress in achieving/maintaining of NAAQS Developing/revising SIPS/evaluating control strategies. Supporting enforcement action. Public Information.
	2. Emergency Episode Abatement Initiation and Monitoring.	Documenting episodes and initiating episode controls. Public information.
B. Population	1. Determination of Population Exposure in Populated Areas	Documenting population exposure and health research. Public Information.
C. Source Imapct	1. Determination of the impact of isolated point sources	Developing/revising SIPs/evaluating strategies. Reviewing new sources. Supporting enforcement actions.
	2. Determination of the Impact of Individual Point Source in Multi-Source Urban Setting.	Developing/revising SIPs/evaluating control strategies. Reviewing new sources Supporting enforcement actions.

D. General Background	1. Determination of Base Concentration in Areas of Projected Growth.	Establishing baseline air quality levels for PSD planning and AQMP. Evaluating progress in achieving/maintaining NAAQS. Developing/revising SIPs to attain/maintain NAAQS. Public Information
	2. Assessment of Background Concentration in Rural Areas.	Establishing baseline air quality levels for PSD planning and AQMP. Developing/revising SIPs to attain/maintain NAAQS Public Information
	3. Diffusion Model Calibration and Refinement.	Estimation of air quality levels.

BIBLIOGRAPHY

1. "A Network Review of Montana's Ambient Air Monitoring," Air Quality Bureau, Montana Department of Health and Environmental Sciences, April, 1979.

2. "Montana 1980 Network Review," Air Quality Bureau, Montana Department of Health and Environmental Sciences, October, 1980.

3. "Selecting Sites for Monitoring Total Suspended Particulates," U.S. EPA, Publication 450/3-77-018, Revised December 1979.

4. "Optimum Site Exposure Criteria for SO_2 Monitoring," U.S., EPA Publication 450/3-77-013, April, 1977.

5. "Selecting Sites for Carbon Monoxide Monitoring," U.S. EPA Publication 450/3-75-077, September 1975.

6. "Site Selection for Monitoring of Photochemical Air Pollutants," U.S. EPA Publication 450/3-78-013, April 1978.

7. "Billings Carbon Monoxide Analysis Update," PEDCo ENVIRONMENTAL, INC., May, 1980.

8. "Ambient Air Quality Monitoring, Data Reporting and Surveillance Provisions," Federal Register, Volume 44, Number 92, May 10, 1979.

9. "Ambient Air Quality Monitoring, Data Reporting and Surveillance Provisions for Lead," Federal Register, Volume 45, Number 199, October 10, 1980.

10. "Particulate and SO_2 Emission Inventory for Non-AQMA Counties in Montana," PEDCo ENVIRONMENTAL, INC., November, 1976.

11. "Billings AQMA Analysis, Suspended Particulate," PEDCo ENVIRONMENTAL, INC. March, 1977.

12. "Volume III Supplementary Reports Prepared for Montana Air Quality Maintenance Area Analysis," PEDCo ENVIRONMENTAL, INC., January, 1979.

13. "Billings SO_2 Dispersion Model," EPA Region VIII, September, 1981.

14. "Survey of Lead in East Helena Snow," (unpublished), Air Quality Bureau, Montana Department of Health and Environmental Sciences, July, 1979.

15. "Air Quality Impact Analysis of the Poplar River Power Plants," Bison Engineering/Research, September, 1980.

16. "X-RayStudies of Airborne Particulate Matter Observed during Wintertime at Missoula, Montana," Briant L. Davis Institute of Atmospheric Sciences, South Dakota School of Mines and Technology, August, 1980.

17. Air Quality Bureau ambient and meteorological printouts.

18. Air Quality Bureau files for Montana Area and Point Source Emission Inventories.

19. "Analysis of Total Suspended Particulate Concentrations at the Greeley School Site in Butte: 1977-1981," Environmental Studies Laboratory, Department of Botany, University of Montana, June, 1982.